PA-H HSSI Port Adapter Installation and Configuration

Product Numbers: PA-H(=) and PA-H-UPG

Platforms Supported: Cisco 7200 Series (including a Cisco 7206 as a router shelf in a Cisco AS5800 Universal Access Server), Cisco 7000 Series and Cisco 7500 Series with VIP2, Cisco uBR7200 Series, Cisco 7100 Series, Catalyst 5000 Family Switches with Catalyst RSM/VIP2

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Preface

This preface explains the objectives and organization of the *PA-H HSSI Port Adapter Installation and Configuration* document and describes how to find information on related products and services.

Objectives

This document describes the installation and configuration of the High-Speed Serial Interface port adapter (PA-H HSSI port adapter), which can be used in the following platforms:

- Cisco 7200 series routers—which consist of the two-slot Cisco 7202, four-slot Cisco 7204 and Cisco 7204VXR, and the six-slot Cisco 7206 and Cisco 7206VXR
- Cisco uBR7200 series universal broadband routers, which consist of the six-slot Cisco uBR7246 (four cable modem card slots and two port adapter slots) and the three-slot Cisco uBR7223 (two cable modem card slots and one port adapter slot)
- Second-generation Versatile Interface Processor (VIP2) in all Cisco 7500 series routers and in Cisco 7000 series routers using the Cisco 7000 Series Route Switch Processor (RSP7000) and Cisco 7000 Series Chassis Interface (RSP7000CI) installed
- Cisco 7100 series routers—which consist of the Cisco 7120 series and Cisco 7140 series
- Catalyst Route Switch Module (RSM)/VIP2 in the Catalyst 5000 family switches

Note The Cisco 7206 and Cisco 7206VXR can be used as router shelves in a Cisco AS5800 Universal Access Server. For Information about the Cisco 7206 and Cisco 7206VXR as router shelves, refer to the Cisco AS5800 Universal Access Server documentation listed in the "Related Documentation" section on page vi.

For complete descriptions of interface subcommands and the configuration options available for interfaces, and which ones support PA-H HSSI port adapter functionality, see the documentation resources listed in the "Related Documentation" section on page vi.

Organization

This document is organized into the following chapters:

Section	Title	Description
Chapter 1	Overview	Describes the PA-H HSSI port adapter, illustrates its location in the supported hardware platforms, and describes its LED displays, cables, and receptacles
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform *before the actual installation*
Chapter 3	VIP2 and the PA-H HSSI Port Adapter	Provides instructions for installing the PA-H HSSI port adapter on a VIP2 interface processor installed in a Cisco 7500 or Cisco 7000 series router
Chapter 4	Catalyst RSM/VIP2 and the PA-H HSSI Port Adapter	Provides instructions for installing the PA-H HSSI port adapter on a Catalyst RSM/VIP2 installed in a Catalyst 5000 family switch
Chapter 5	Cisco 7200 Series and the PA-H HSSI Port Adapter	Provides instructions for installing the PA-H HSSI port adapter in a Cisco 7200 series router
Chapter 6	Cisco uBR7200 Series and the PA-H HSSI Port Adapter	Provides instructions for installing the PA-H HSSI port adapter in Cisco uBR7200 series universal broadband routers
Chapter 7	Cisco 7100 Series and the PA-H HSSI Port Adapter	Provides instructions for installing the PA-H HSSI port adapter in Cisco 7100 series routers
Chapter 8	Cable Installation and Interface Configuration	Provides instructions for installing port adapter cables and configuring your port adapter on the supported platforms. The instructions given in Chapter 8 apply to all supported platforms described in this document

Related Documentation

Your router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- For Cisco IOS software configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

  Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

- For hardware installation and maintenance information on the Cisco 7000 series and Cisco 7500 series routers, and the VIP2, refer to the following publications:
  - The installation and configuration guide that shipped with your Cisco 7000 series or Cisco 7500 series router
  - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* (for VIP2 users only)

- For hardware installation and maintenance information on the Catalyst 5000 family switch, and the Catalyst RSM/VIP2, refer to the following publications:
  - The installation and configuration guide that shipped with your Catalyst 5000 family switch
  - *Route Switch Module Catalyst VIP2-15 and VIP2-40 Installation and Configuration Note* (Document Number 78-4780-01) which shipped with your Catalyst RSM/VIP2
- For hardware installation and maintenance information on the Cisco 7100 series routers, refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide* that shipped with your Cisco 7100 series router.
- For information on setting up a Virtual Private Network, see the *Cisco 7100 Series VPN Configuration Guide*.
- For hardware installation and maintenance information on the Cisco 7200 VXR routers, refer to the *Cisco 7200 VXR Installation and Configuration Guide* that shipped with your Cisco 7200 VXR router.
- For hardware installation and maintenance information on the Cisco 7200 routers, refer to the *Cisco 7200 series Installation and Configuration Guide* that shipped with your Cisco 7200 series.
- For port adapter hardware and memory configuration guidelines for the Cisco 7200 series routers (including a Cisco 7206 and Cisco 7206VXR as router shelves in the Cisco AS5800 Universal Access Server), refer to the document *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
- For hardware installation and maintenance information on the Cisco uBR7200 series universal broadband router, refer to the *Cisco uBR7246 Broadband Router Installation and Configuration Guide* that shipped with your Cisco uBR7246 universal broadband router, or the *Cisco uBR7223 Universal Broadband Router Installation and Configuration Guide* that shipped with your Cisco uBR7223.
- For hardware installation and maintenance information and software configuration information on the Cisco AS5800 Universal Access Server, refer to the following publications:
  - *Cisco AS5800 Universal Access Server Hardware Installation and Configuration Guide*
  - *Cisco AS5800 Universal Access Server Software Installation and Configuration Guide*
- For international agency compliance, safety, and statutory information for WAN interfaces for the Cisco 7500 series, Cisco 7000 series, Cisco 7200 series routers, the Cisco uBR7200 series universal broadband routers, the Cisco AS5800 Universal Access Server, and the Cisco 7100 series routers refer to the following publications:
  - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7000 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7200 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco uBR7246 Universal Broadband Router* or *Regulatory Compliance and Safety Information for the Cisco uBR7223 Universal Broadband Router*
  - *Cisco AS5800 Universal Access Server Regulatory Compliance and Safety Information*
  - *Regulatory Compliance and Safety Information for the Cisco 7100 Series VPN Routers*

Note The regulatory compliance and safety information documentation listed above applies to the Catalyst 5000 family switches and the Catalyst RSM/VIP2.

- For general information about documentation, see the "Documentation CD-ROM" section on page ix, the "Cisco Connection Online" section on page viii or call Customer Service at 800 553-6387 or 408 526-7208. Customer Service hours are 5:00 a.m. to 6:00 p.m. Pacific time, Monday through Friday (excluding Cisco-observed holidays). You can also send e-mail to cs-rep@cisco.com, refer to the *Cisco Information Packet* that shipped with your router, or access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

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WWW: http://www-europe.cisco.com

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Telnet: cco.cisco.com

Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact cco-help@cisco.com. For additional information, contact cco-team@cisco.com.

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Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more current than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

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Overview

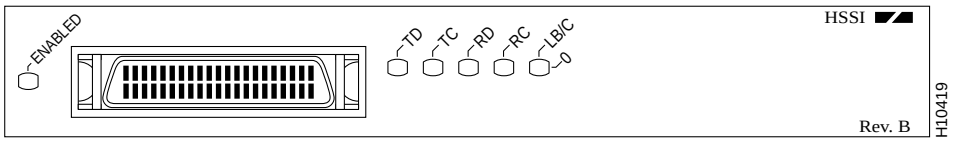
This chapter provides physical and functional overviews of the PA-H HSSI port adapter. The chapter contains the following sections:

- Port Adapter Overview, page 1-1
- Port Adapter Locations on the Supported Platforms, page 1-3
- LEDs, page 1-6
- Receptacles, Cables, and Pinouts, page 1-7

Port Adapter Overview

The PA-H Rev. B HSSI port adapter provides one high-speed serial interface. (See Figure 1-1.)

Figure 1-1 PA-H Rev. B Port Adapter—Faceplate View



The PA-H HSSI port is a female, 50-pin, SCSI-II-type connector. You must use a HSSI interface cable to connect the interface with an external data service unit (DSU). See the "Receptacles, Cables, and Pinouts" section on page 1-7 for descriptions of HSSI cables.

The PA-H conforms to BABT/TC/130 and EIA/TIA-612 and EIA/TIA-613 standards. The PA-H provides a single network interface for Cisco 7000 series, Cisco 7500 series, Cisco 7200 series routers (including a Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), Cisco uBR7200 series universal broadband routers, and Cisco 7100 series routers. Each PA-H provides a full-duplex synchronous serial interface for transmitting and receiving data at rates of up to 52 megabits per second (Mbps).

HSSI, which was recently standardized as EIA/TIA 612/613, provides access to services at T3 (45-Mbps), E3 (34-Mbps), and Synchronous Optical Network (SONET) STS-1 (51.82-Mbps) rates. The actual rate of the interface depends on the external data service unit (DSU) and the type of service to which it is connected.

The PA-H supports both 16- and 32-bit cyclic redundancy checks (CRCs). The default is 16-bit CRCs; to enable 32-bit CRCs, you use a configuration command. (For a description of the CRC function, see the "Configuring Cyclic Redundancy Checks" section on page 8-8.)

The BABT605559 marking on the PA-H HSSI port adapter signifies that the port adapter meets United Kingdom directive 605559 and has been designed to BABT/TC/130 standards. The BABT label is located on the top of each PA-H HSSI port adapter.

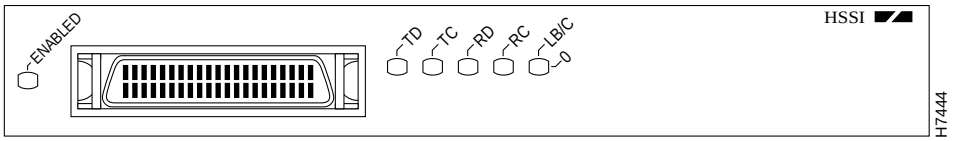
Figure 1-2 shows the BABT label for the PA-H HSSI port adapter.

Figure 1-2 BABT Label for the PA-H HSSI Port Adapter

Note The PA-H has been revised to Revision B.

This newest single-port PA-H can be identified by *Rev. B* in the lower right corner of its front-panel label. (See Figure 1-1.) The older PA-H does *not* have *Rev. B* on its label. (See Figure 1-3.) (We recommend that you use the PA-H Rev. B port adapter shown in Figure 1-1.)

Figure 1-3 Older PA-H HSSI Port Adapter—Pre-Rev. B



The PA-H can be installed in the following slots on the hardware platforms described in this document:

- VIP2—Port adapter slot 0 and port adapter slot 1
- Catalyst RSM/VIP2—Port adapter slot 0 and port adapter slot 1
- Cisco 7200 series routers—Port adapter slot 1 and slot 2 of the Cisco 7202; port adapter slot 1 through slot 4 of the Cisco 7204 and Cisco 7204VXR; port adapter slot 1 through slot 6 of the Cisco 7206 and Cisco 7206VXR
- Cisco uBR7200 series routers—Port adapter slot 1 or slot 2 of the Cisco uBR7246 and port adapter slot 1 of the Cisco uBR7223
- Cisco 7100 series routers—Port adapter slot 3 of the Cisco 7120 series and port adapter slot 4 of the Cisco 7140 series

Port adapters have a handle attached, but this handle is occasionally not shown to allow a full view of the port adapter's faceplate.

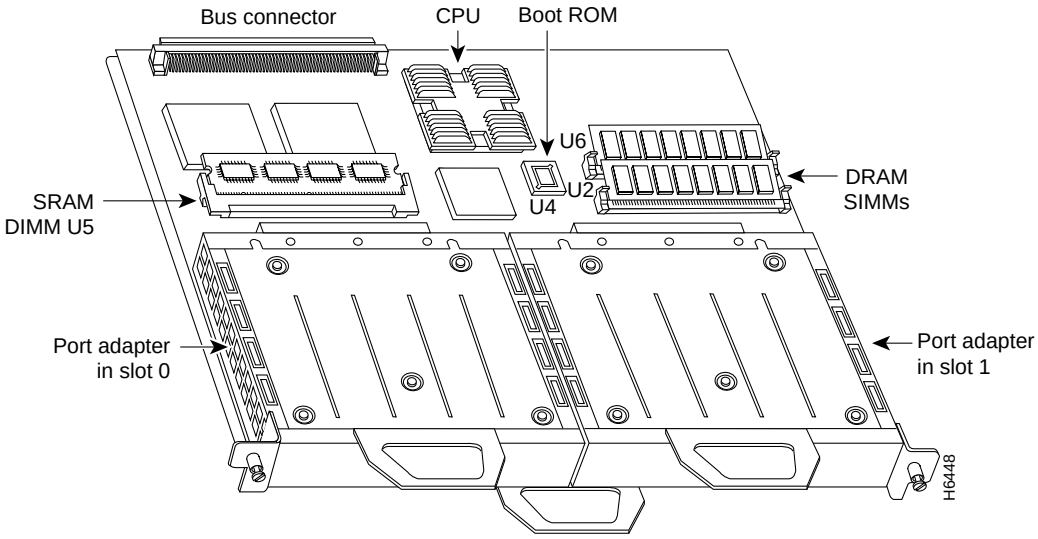
Note Although the VIP2 and Catalyst RSM/VIP2 support online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP2 or Catalyst RSM/VIP2 from the chassis, and then replace port adapters as required.

The Cisco 7100 series, Cisco 7200 series, and the Cisco uBR7246 routers support the OIR of all port adapter types.

Port Adapter Locations on the Supported Platforms

Figure 1-4 shows a VIP2-15 or VIP2-40 with installed port adapters. With the VIP2 oriented as shown in Figure 1-4, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1.

Figure 1-4 VIP2-15, VIP2-20 or VIP2-40 with Two Port Adapters Installed—Horizontal Orientation



Note In the Cisco 7000, Cisco 7507, and Cisco 7513 chassis, the VIP2 is installed vertically. In the Cisco 7010 and Cisco 7505 chassis, the VIP2 is installed horizontally.

Figure 1-5 shows a VIP2-50 with installed port adapters.

Figure 1-5 VIP2-50 with Two Port Adapters Installed—Horizontal Orientation

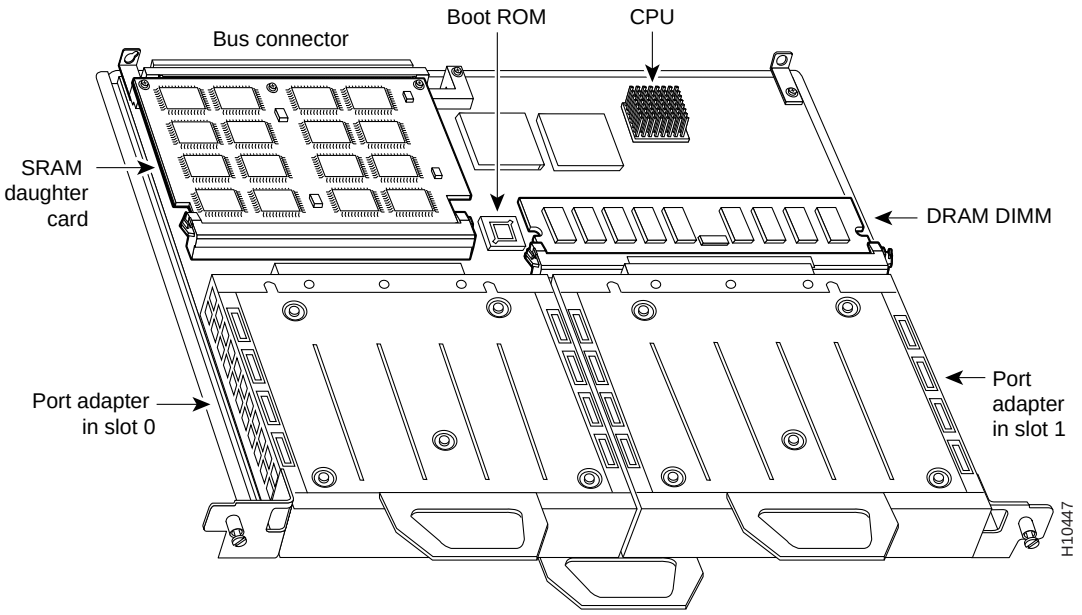


Figure 1-6 shows a Catalyst RSM/VIP2-40 with installed blank port adapters. With the Catalyst RSM/VIP2 oriented as shown in Figure 1-6, the left port adapter is in port adapter slot 0, and the right port adapter is in port adapter slot 1.

Figure 1-6 Catalyst RSM/VIP2-40 with Two Port Adapters Installed

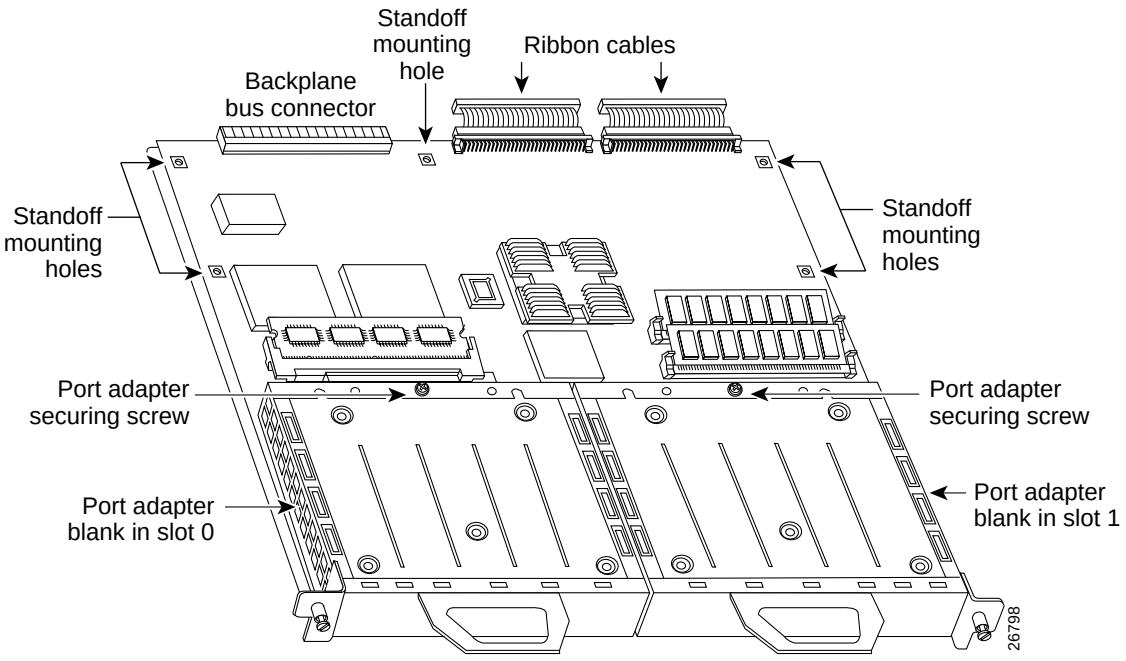


Figure 1-7 shows a Cisco 7206 with port adapters installed. In the Cisco 7206 (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), port adapter slot 1 is in the lower left position, and port adapter slot 6 is in the upper right position. (The Cisco 7202 and Cisco 7204 are not shown; however, the PA-H can be installed in any available port adapter slot.)

Figure 1-7 Port Adapter Slots in the Cisco 7206

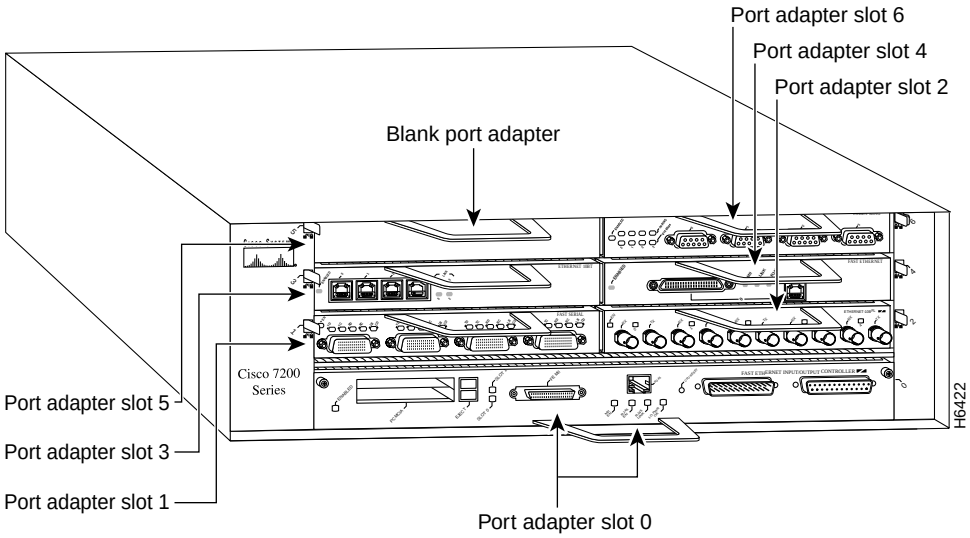
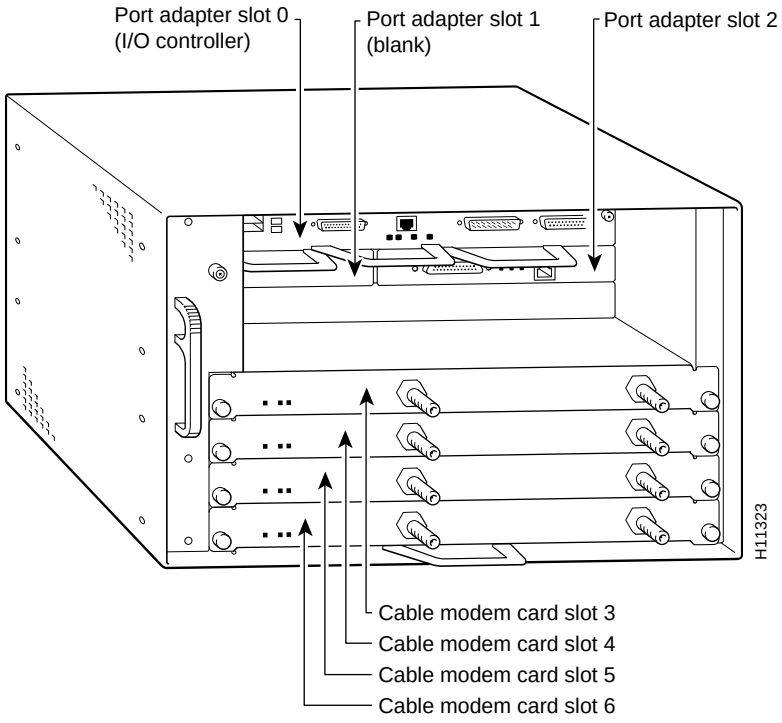


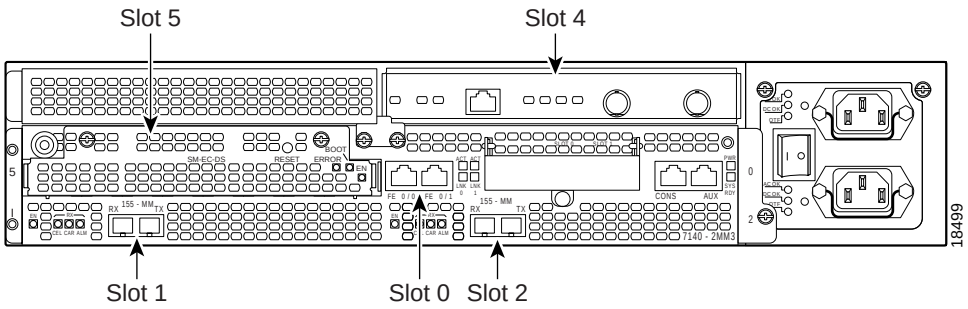
Figure 1-8 shows a Cisco uBR7200 series router with port adapters installed. In the Cisco uBR7246, port adapter slot 1 is in the upper left position, and port adapter slot 2 is in the upper right position. In the Cisco uBR7223, port adapter slot 1 is in the upper right position. The port adapters are recessed into the chassis just below the I/O controller.

Figure 1-8 Port Adapters in the Cisco uBR7200 Series Universal Broadband Router—Cisco uBR7246



The PA-H can be installed in port adapter slot 3 in Cisco 7120 series routers, and in port adapter slot 4 in Cisco 7140 series routers. Figure 1-9 shows a Cisco 7140 with a port adapter installed in slot 4.

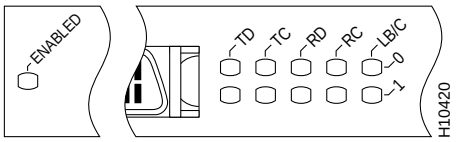
Figure 1-9 Port Adapters in the Cisco 7100 Series Router—Cisco 7140



LEDs

The PA-H has two rows of five status LEDs, one row of five for each HSSI port on the port adapter (TD, TC, RD, RC, and LB/C), and one enabled LED for the port adapter. (See Figure 1-10 and Table 1-1.)

Figure 1-10 LEDs on the PA-H HSSI Port Adapter—Partial Front View



After system initialization, the enabled LED, which is present on all interface processors, goes on to indicate that the port adapter has been enabled for operation.

The following conditions must be met before the PA-H is enabled:

- The port adapter contains a valid microcode version that has successfully been downloaded
- The port adapter is correctly connected to the backplane and receiving power in Cisco 7000 series and Cisco 7500 series routers, or to the midplane and receiving power in Cisco 7100 series routers Cisco 7200 series routers and Cisco uBR7200 series routers
- The bus recognizes the port adapter or PA-H-equipped VIP2

If any of these conditions is not met, or if the initialization fails for other reasons, the enabled LED does not go on.

Table 1-1 PA-H Port LEDs

LED Label	Color	State	Function
TD	Green	On	DTE—Transmit data out. DCE—Transmit data in.
TC	Green	On	DTE—Transmit clock in. DCE—Transmit clock in (TXCE).
RD	Green	On	DTE—Receive data in. DCE—Receive data out.
RC	Green	On	DTE—Receive clock in. DCE—Receive clock out.
LB/CD	Green	On	Indicates DTR, DSR, RTS, CTS, or DCD is active.
	Green	Flashing	Indicates RTS, CTS, or DCD is sending and receiving data in half-duplex mode.
	Yellow	On	Indicates local loop or internal loop active.

Receptacles, Cables, and Pinouts

Two types of cables are available for use with the PA-H HSSI port adapter: the HSSI interface cable used to connect your router to an external DSU (and HSSI network) and a null modem cable, which allows you to connect two routers back to back. Both HSSI cables conform to EIA/TIA-612 and EIA/TIA-613 specifications. The HSSI port on the PA-H is considered to be a DTE device.

HSSI Interface Cable

The HSSI cable (CAB-HSI1=) connects the PA-H with the external DSU. The HSSI cable is 10-feet (3.048 meters) long. The maximum cable length is 50 feet (15.24 meters). Figure 1-11 shows the HSSI cable. Table 1-2 lists the pinout.

Figure 1-11 HSSI Interface Cable Connector

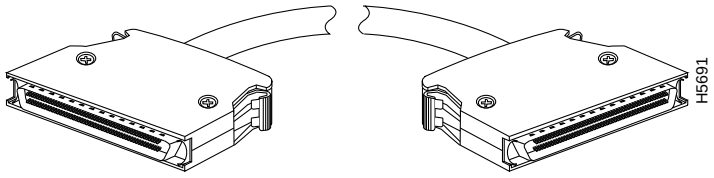


Table 1-2 HSSI Interface Cable Pinout

Signal Name	+ Side Pin No.	– Side Pin No.	Direction[1] Router	DSU
SG (Signal Ground)	1	26	—	
RT (Receive Timing)	2	27	<—	
CA (DCE Available)	3	28	<—	
RD (Receive Data reserved)	4	29	<—	
LC (Loopback circuit C)	5	30	<—	
ST (Send Timing)	6	31	<—	
SG (Signal Ground)	7	32	—	
TA (DTE Available)	8	33	—>	
TT (Terminal Timing)	9	34	—>	
LA (Loopback circuit A)	10	35	—>	
SD (Send Data)	11	36	—>	
LB (Loopback circuit B)	12	37	—>	
SG (Signal Ground)	13	38	—	
5 (Ancillary to DCE)	14–18	39–43	—>	
SG (Signal Ground)	19	44	—	
5 (Ancillary from DCE)	20–24	45–49	<—	
SG (Signal Ground)	25	50	—	

1 Router is + side (DTE). DSU is – side (DCE).

HSSI Null Modem Cable

The null modem cable (CAB-HNUL=) can connect two routers directly back to back. The null modem cable is 10-feet (3.048 meters) long. The maximum null modem cable length allowed is 50 feet (15.24 meters). The two routers must be in the same location and can be two Cisco 7000 series routers, two Cisco 7500 series routers, two Cisco 7200 series routers, two Cisco uBR7200 series universal broadband routers, two Cisco 7100 series routers, or any combination of each. A null modem connection allows you to verify the operation of the HSSI or to link the routers directly in order to build a larger node. Figure 1-12 shows the null modem cable. The null modem cable uses

the same 50-pin connectors as the HSSI cable, but uses the pinout listed in Table 1-3. (For connection and configuration instructions, see the "Attaching a Null Modem Cable to PA-H HSSI Port Adapters" section on page 8-2.)

Figure 1-12 Null Modem Cable Connectors

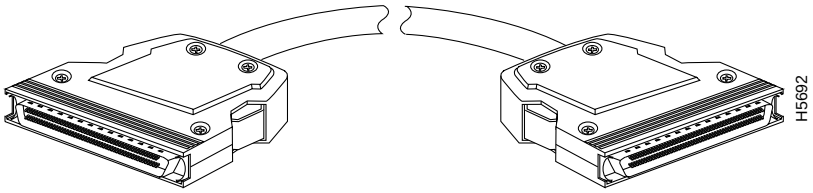


Table 1-3 HSSI Null Modem Cable Pinout

Signal Name	From Pins	Direction	To Pins	Signal Name
RT (Receive Timing)	2, 27	—>	9, 34	TT (Terminal Timing)
CA (DCE available)	3, 28	—>	8, 33	TA (DTE Available)
RD (Receive Data)	4, 29	—>	11, 36	SD (Send Data)
LC (Loopback C)	5, 30	—>	10, 35	LA (Loopback A)
ST (Send Timing)	6, 31	—>	6, 31	ST (Send Timing)
TA (DTE available)	8, 33	—>	3, 28	CA (DCE Available)
TT (Terminal Timing)	9, 34	—>	2, 27	RT (Receive Timing)
LA (Loopback A)	10, 35	—>	5, 30	LC (Loopback C)
SD (Send Data)	11, 36	—>	4, 29	RD (Receive Data)
GND (Ground)	1, 26, 7, 32, 13, 38, 19, 44, 25, 50		1, 26, 7, 32, 13, 38, 19, 44, 25, 50	GND (Ground)
Loopback (not connected)	12, 37		12, 37	Loopback (not connected)
Not used	14–18, 20–24, 39–43, 45–49		14–18, 20–24, 39–43, 45–49	Not used

Caution Although the HSSI connector and the HSSI cable are similar to SCSI-II format, they are not identical. The HSSI cable specification is more stringent than that for the SCSI-II. If a SCSI-II cable is used instead of a HSSI cable, proper operation cannot be guaranteed.

Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the PA-H HSSI port adapters. The chapter contains the following sections:

- Required Parts and Tools, page 2-1
- Software and Hardware Requirements, page 2-2
- Safety Guidelines, page 2-3
- FCC Class B Compliance, page 2-6

Required Parts and Tools

You need the following tools and parts to install a port adapter. If you need additional equipment, contact a service representative for ordering information.

- Port adapter PA-H(=) or PA-H-UPG and one of the following:
  - VIP2-15(=), VIP2-20, VIP2-40(=), or VIP2-50(=)
  - Catalyst RSM/VIP2-15(=) or Catalyst RSM/VIP2-40(=)
  - Cisco 7200 series router or a Cisco 7206 or Cisco 7206VXR router shelf in a Cisco AS5800 Universal Access Server with at least one available port adapter slot
  - Cisco uBR7200 series router with at least one available port adapter slot
  - Cisco 7100 series router with at least one available port adapter slot
- HSSI cables CAB-HSI1= or CAB-HNUL=, as appropriate for the port adapter's interfaces (HSSI cables for the PA-H are available *only* from Cisco Systems; they are *not* available from outside commercial cable vendors)

Caution Although the port adapter's HSSI connector and the HSSI cable are similar to SCSI-II format, they are not identical. The HSSI cable specification is more stringent than that for SCSI-II. If a SCSI-II cable is used instead of an HSSI cable, proper operation cannot be guaranteed.

- Number 1 Phillips and a 3/16-inch flat-blade screwdriver
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares

Software and Hardware Requirements

Table 2-1 lists the minimum Cisco IOS software release required to use the PA-H HSSI port adapter in supported router platforms.

Table 2-1 HSSI Port Adapter Software Requirements

Platform	Recommended Minimum Cisco IOS Release
Cisco 7000 series and Cisco 7500 series	
• With VIP2-15(=), VIP2-20(=) or VIP2-40(=)	Cisco IOS Release 11.1(12)CA or a later release of Cisco IOS Release 11.1 CA Cisco IOS Release 11.2(9)P or a later release of Cisco IOS Release 11.2 P
• With VIP2-50(=)	Cisco IOS Release 11.1(14)CA or a later release of Cisco IOS Release 11.1 CA
Cisco 7200 series	
• Cisco 7204VXR and Cisco 7206VXR	Cisco IOS Release 12.0(2)XE2 or a later release of Cisco IOS Release 12.0 XE Cisco IOS Release 12.0(3)T or a later release of Cisco IOS Release 12.0 T
• Cisco 7204 and Cisco 7206	Cisco IOS Release 11.3(2)AA or a later release of Cisco IOS Release 11.3 AA
• Cisco 7202	Cisco IOS Release 11.1(19)CC1 or a later release of Cisco IOS Release 11.1 CC Cisco IOS Release 11.3(4)AA or a later release of Cisco IOS Release 11.3 AA
• Cisco 7206 router shelf	Cisco IOS Release 11.3(2)AA or later release of Cisco IOS Release 11.3 AA
Cisco uBR7200 series	
• Cisco uBR7246 and Cisco uBR7223	Cisco IOS Release 11.3(7)NA or later release of Cisco IOS Release 11.3 NA Cisco IOS Release 12.0(3)T or later release of Cisco IOS Release 12.0 T
Cisco 7100 series	
• Cisco 7120 series and Cisco 7140 series	Cisco IOS Release 12.0(4)XE or a later release of Cisco IOS Release 12.0 XE Cisco IOS Release 12.0(5)T or a later release of Cisco IOS Release 12.0 T
Catalyst 5000 family switches	
• With VIP2-15(=) or VIP2-40(=)	Cisco IOS Release 11.2(15A)P or a later release of Cisco IOS Release 11.2P Cisco IOS Release 11.2(15A)P or a later release of Cisco IOS Release 11.2P

In the Cisco 7000 or Cisco 7500 series routers, the single-port PA-H requires the following VIP2 models:

- VIP2-15 (1 MB of SRAM, 8 MB of DRAM)
- VIP2-20 (1 MB of DRAM, 16 MB of SRAM)
- VIP2-40 (2 MB of SRAM, 32 MB of DRAM)
- VIP2-50 (4 to 8 MB of SRAM, 32 to 128 MB of DRAM

In the Catalyst 5000 family switches, the single-port PA-H requires the following Catalyst RSM/VIP2 models:

- VIP2-15 (1 MB of SRAM, 16 MB of DRAM)
- VIP2-40 (2 MB of SRAM, 32 MB of DRAM)

Note At a minimum, we recommend that the PA-H be installed on the VIP2-15 motherboard (with 1 MB of SRAM and 8 MB of DRAM) or Catalyst RSM/VIP2 motherboard (with 1 MB of SRAM and 16 MB of DRAM).

The VIP2-10 has certain configuration constraints because of its limited SRAM for packet buffers; therefore, we do not recommend that you use the PA-H on the VIP2-10 (with 512 KB of SRAM and 8 MB of DRAM).

Caution To prevent system problems, the VIP2 requires that the host Cisco 7000 series router has the RSP7000 and RSP7000CI installed. The VIP2 will *not* operate properly with the Route Processor (RP), Switch Processor (SP), or Silicon Switch Processor (SSP) installed in the host Cisco 7000 series router.

Caution If you are using the high-speed serial interface (HSSI) port adapter in the Catalyst 5000, 5500, 5505, or 5509 switch, you must install the port adapter on the Catalyst RSM/VIP2 (either -15 or -40) Revision 2 (board part number 73-3468-XX, where XX is the version number). Do not use the HSSI dual-port adapter in the Catalyst 5000, 5505, or 5509 switch if you are installing it on a Catalyst RSM/VIP2 (either -15 or -40) module that is not the Revision 2. If you fail to comply with this restriction, your system will shut down due to an overload of the power supply.

Caution You can only have two HSSI port adapters per chassis when installed on a Catalyst RSM/VIP2-15 or -40 module Revision 1 and used in the Catalyst 5500 switch.

In Cisco 7000 series and Cisco 7500 series routers, there are no restrictions on slot locations or sequence; however, there are restrictions on the maximum number of PA-H HSSI port adapters that you can install in a Cisco 7000 series or Cisco 7500 series router. The recommended maximum number of PA-H HSSI port adapters for the Cisco 7000, Cisco 7010, Cisco 7505, and Cisco 7507 is 4. The recommended maximum number of PA-H HSSI port adapters for the Cisco 7513 is 12.

In Cisco 7200 series routers, there are specific configuration guidelines that must be observed for high-bandwidth port adapters such as the single-port PA-H. For port adapter hardware and memory configuration guidelines for Cisco 7200 series routers (including the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), refer to the document *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*, that shipped with your Cisco 7200 series router.

Note Port adapters used with the Cisco 7200 VXR routers require the correct base hardware revision to function. The following error message will occur on bootup if the incorrect hardware revision is used:

```
PA-3-REVNOTSUPPORTED:PA in slot 1 (Mx HSSI-B) requires base h/w revision of (1.17)
for this chassis
```

Use the **show diag** command to display the hardware revision. (See the “Cisco 7200 Series, Cisco uBR7200 Series, and Cisco 7100 Series show Commands” section on page 8-10.)

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.

Warning This warning symbol means *danger.* You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjasesta (määräysten noudattaminen ja tietoa turvallisuudesta).

Attention Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.

¡Advertencia! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. Se förklaringar av de varningar som förkommer i denna publikation i dokumentet *Regulatory Compliance and Safety Information* (Efterrättelse av föreskrifter och säkerhetsinformation), vilket medföljer denna anordning.

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist and never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe. Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Port adapters and processor modules comprise printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.
- Place a removed component board-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms.

FCC Class B Compliance

The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the equipment to one side or the other of the television or radio.
- Move the equipment farther away from the television or radio.

- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

VIP2 and the PA-H HSSI Port Adapter

This chapter provides information on the PA-H HSSI port adapter and its use on the VIP2 in Cisco 7000 series and Cisco 7500 series routers. This chapter contains the following section:

- Installation Overview, page 3-1

Installation Overview

The PA-H is used on the VIP2, and can be installed in either port adapter slot 0 or port adapter slot 1. Figure 3-1 shows one PA-H Rev. B installed in port adapter slot 0 on a VIP2-15 or VIP2-40.

Figure 3-1 VIP2-15 or VIP2-40 with One PA-H Rev. B in Port Adapter Slot 0

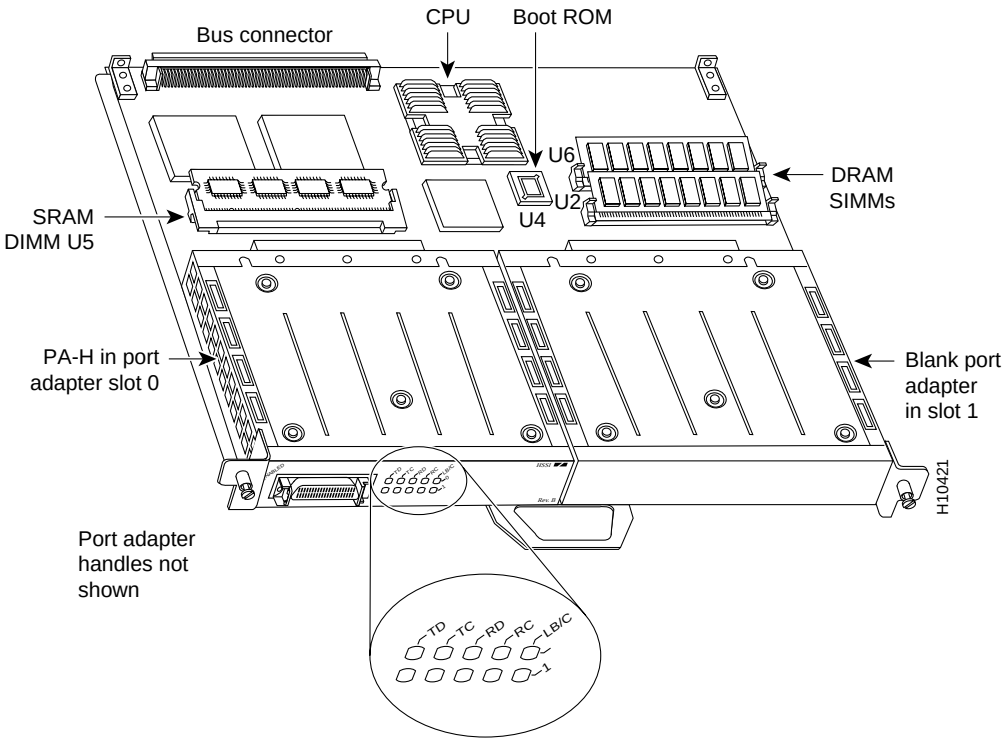
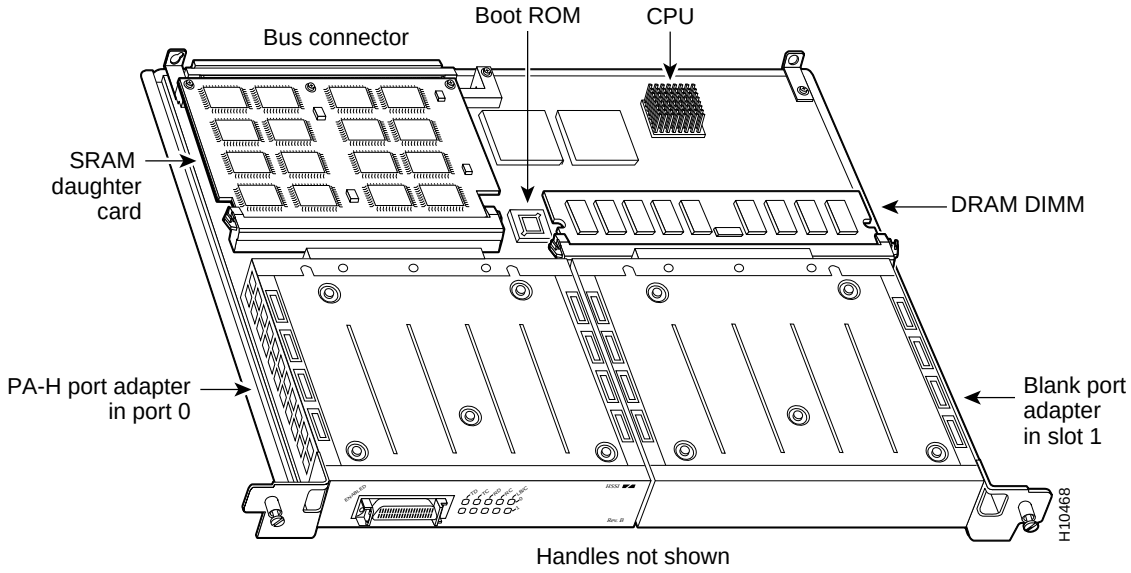


Figure 3-2 shows one PA-H Rev. B installed in port adapter slot 0 on a VIP2-50.

Figure 3-2 VIP2-50 with One PA-H Rev. B in Port Adapter Slot 0



Note Port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Depending on the circumstances, you might need to install a new port adapter on a VIP2 motherboard or replace a failed port adapter in the field. In either case, you need a number 1 Phillips screwdriver, an antistatic mat onto which you can place the removed interface processor, and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

Caution To prevent system problems, do not remove port adapters from the VIP2 motherboard, or attempt to install other port adapters on the VIP2 motherboard while the system is operating. To install or replace port adapters, first remove the VIP2 from its interface processor slot.

Note Each port adapter circuit board is mounted to a metal carrier and is sensitive to ESD damage. Each port adapter has one Phillips-head screw that secures it to its port adapter slot. We strongly recommend that the following procedures be performed by a Cisco-certified service provider; however, this is not a requirement.

While the VIP2 supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the VIP2 from the chassis, and then install or replace port adapters as required. If a blank port adapter is installed on the VIP2 in which you want to install a new port adapter, you must first remove the VIP2 from the chassis, and then remove the blank port adapter.

When only one port adapter is installed on a VIP2, a blank port adapter must fill the empty slot to allow the VIP2 and router chassis to conform to electromagnetic interference (EMI) emissions requirements, and so that air flows through the chassis properly. If you plan to install a new port adapter, you must first remove the blank port adapter.

Note The BABT605559 marking on the PA-H (see Figure 1-2) signifies that the port adapter meets United Kingdom directive 605559 and has been designed to BABT/TC/130 standards.

Use the following standard procedure to remove and replace any type of port adapter on a VIP2:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Note To install a new port adapter on a VIP2 with a single port adapter, you must first remove the blank port adapter from the port adapter slot in which you want to install the new port adapter.

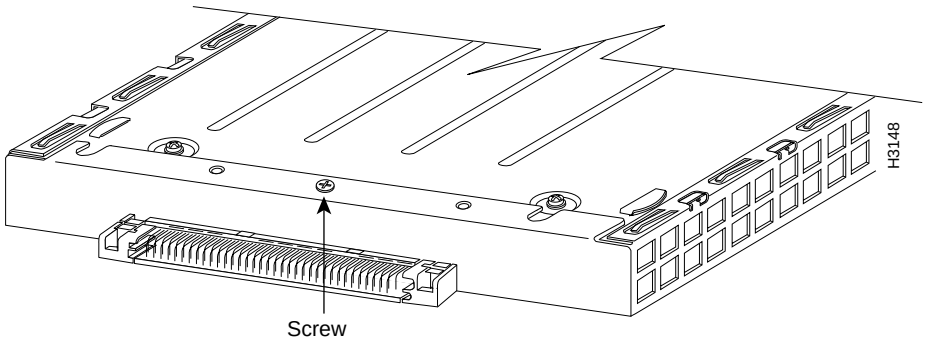
Step 2 For a new port adapter installation or a port adapter replacement, disconnect any interface cables from the ports on the front of the port adapter, although this is not required. You can remove VIP2s with cables attached; however, we do not recommend it.

Step 3 Remove the VIP2 from the system. (Follow the steps in the section "Removing a VIP2" in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* that shipped with your VIP2.)

Step 4 Place the removed VIP2 on an antistatic mat.

Step 5 Locate the screw at the rear of the port adapter (or blank port adapter) to be replaced. (See Figure 3-3.) This screw secures the port adapter (or blank port adapter) to its slot.

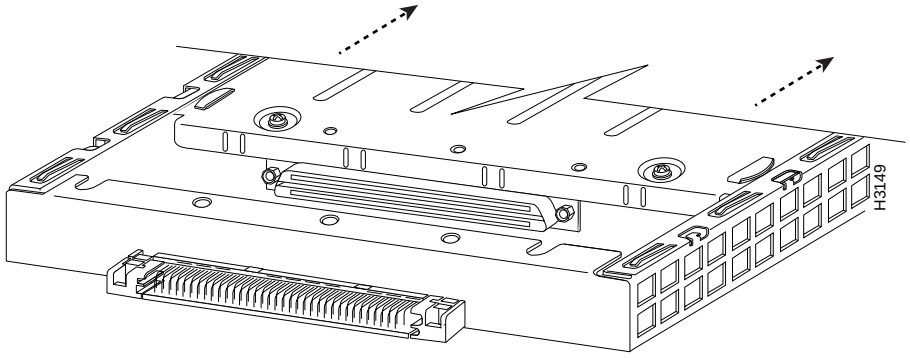
Figure 3-3 Location of Port Adapter Screw—Partial Port Adapter View



Step 6 Remove the screw that secures the port adapter (or blank port adapter).

Step 7 With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See Figure 3-4.)

Figure 3-4 Pulling a Port Adapter Out of a Slot—Partial Port Adapter View

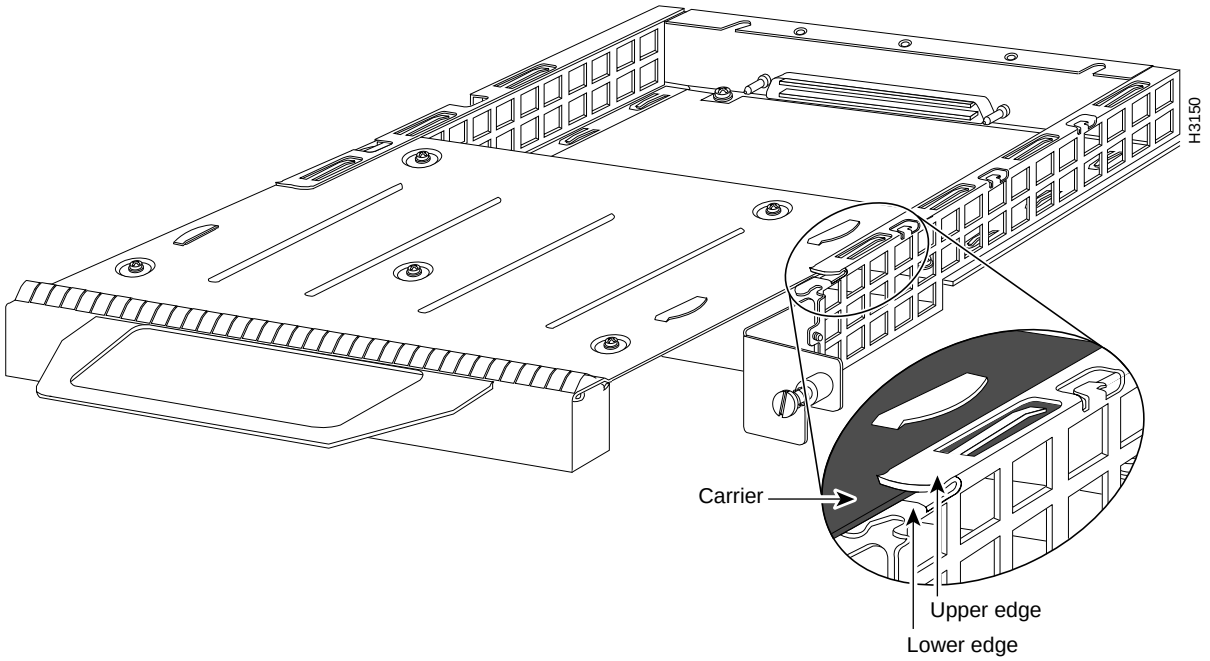


Step 8 If you removed a port adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank port adapter, no special handling is required; however, store the blank port adapter for potential future use.

Step 9 Remove the new port adapter from its antistatic container and position it at the opening of the slot. (See Figure 3-5.)

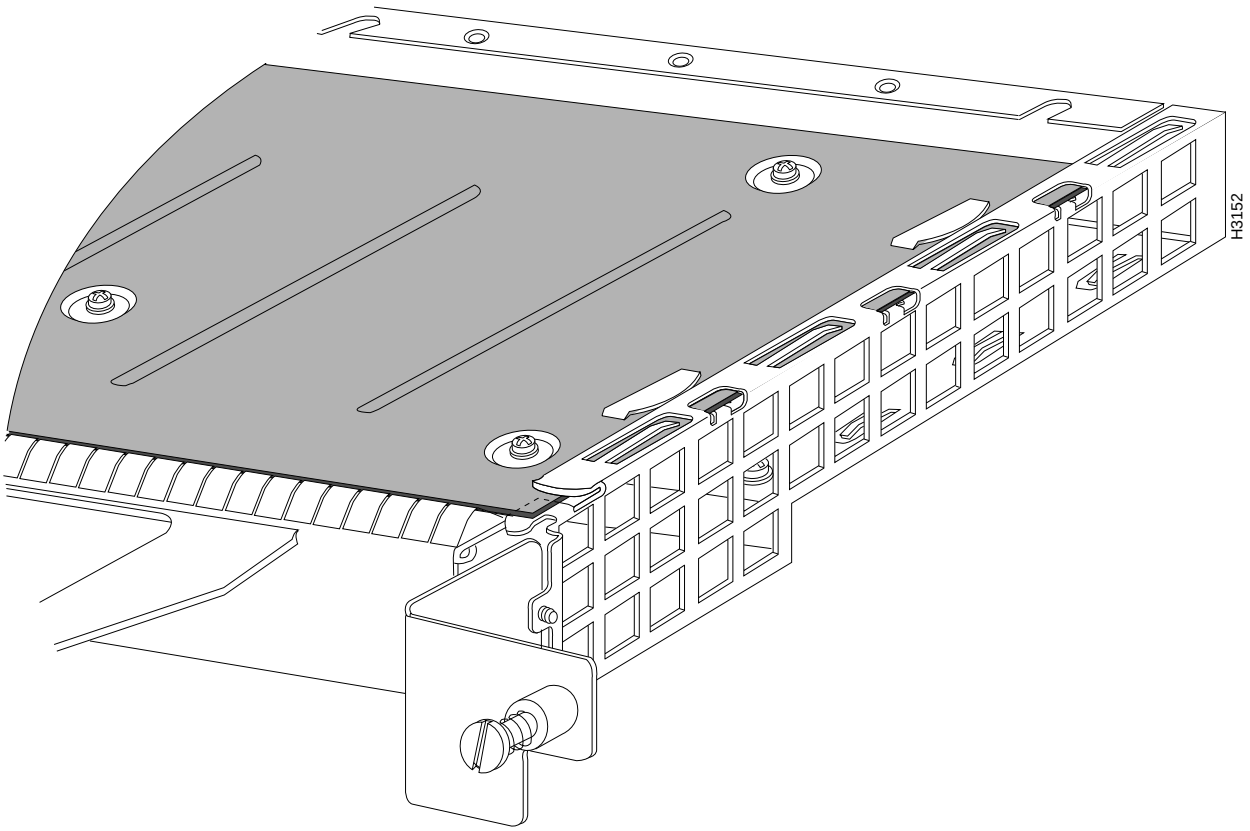
Caution To prevent jamming the carrier between the upper and lower edges of the port adapter slot, and to assure that the edge connector at the rear of the port adapter mates with the connector at the rear of the port adapter slot, make certain that the leading edges of the carrier are between the upper and lower slot edges, as shown in the cutaway in Figure 3-5.

Figure 3-5 Aligning a Port Adapter in a Port Adapter Slot



Step 10 Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely mated with the connector on the motherboard (see Figure 3-6).

Figure 3-6 Port Adapter Installed in a Port Adapter Slot—Partial Port Adapter View



Step 11 Replace the screw in the rear of the port adapter slot. (See Figure 3-3 for its location.) Do not overtighten this screw.

Step 12 Reinstall the VIP2 in the system. (Follow the steps in the section "Installing a VIP2" in the configuration note *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration* that shipped with your VIP2.)

Step 13 If disconnected, reconnect the interface cables to the port adapters.

This completes the procedure for installing a new port adapter or replacing a port adapter on a VIP2. To install the necessary cables and configure your PA-H, proceed to Chapter 8, "Cable Installation and Interface Configuration."

Catalyst RSM/VIP2 and the PA-H HSSI Port Adapter

This chapter provides information on the PA-H HSSI port adapter and its use on the Catalyst RSM/VIP2 in the Catalyst 5000 family switches. This chapter contains the following section:

- Installation Overview, page 4-1

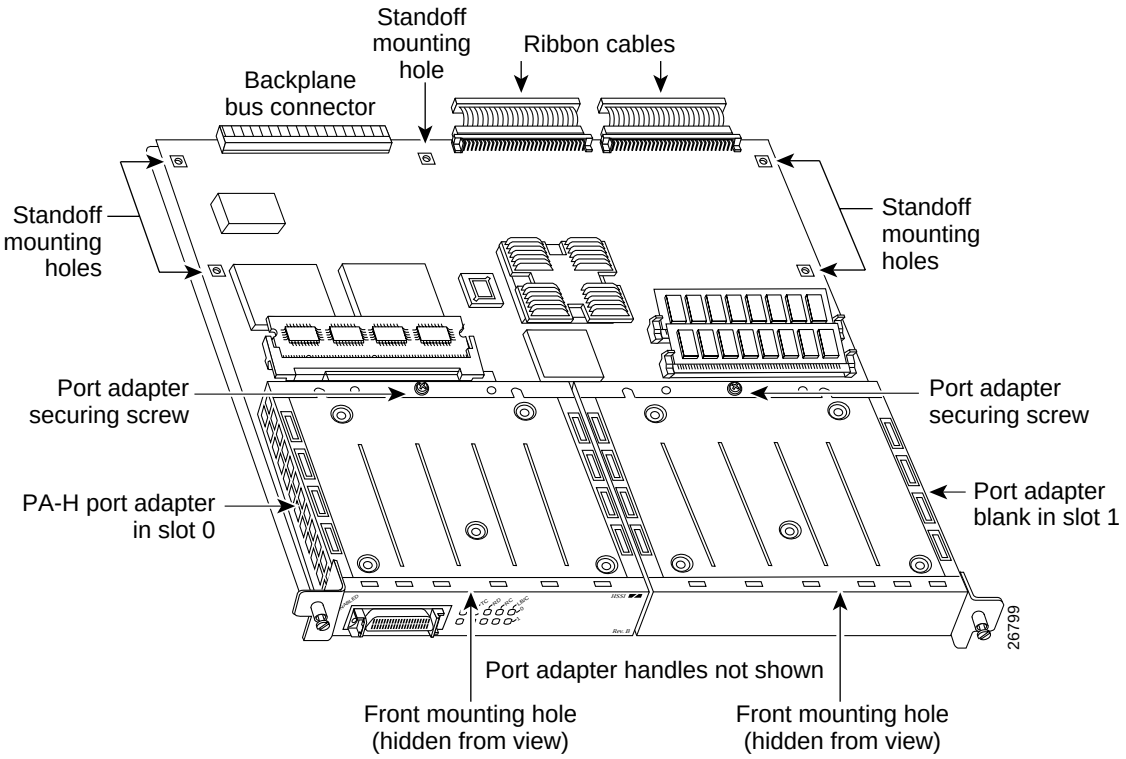
Caution If you are using the high-speed serial interface (HSSI) port adapter in the Catalyst 5000, 5500, 5505, or 5509 switch, you must install the port adapter on the Catalyst RSM/VIP2 (either -15 or -40) Revision 2 (board part number 73-3468-XX, where XX is the version number). Do not use the HSSI dual-port adapter in the Catalyst 5000, 5505, or 5509 switch if you are installing it on a Catalyst RSM/VIP2 (either -15 or -40) module that is not the Revision 2. If you fail to comply with this restriction, your system will shut down due to an overload of the power supply.

Caution You can only have two HSSI port adapters per chassis when installed on a Catalyst RSM/VIP2-15 or -40 module Revision 1 and used in the Catalyst 5500 switch.

Installation Overview

The PA-H is used on the Catalyst RSM/VIP2, and can be installed in either port adapter slot 0 or port adapter slot 1. Figure 4-1 shows one PA-H installed in port adapter slot 0 on a Catalyst RSM/VIP2-40.

Figure 4-1 Catalyst RSM/VIP2-40 with One PA-H in Port Adapter Slot 0


Standoff mounting hole
Ribbon cables
Backplane bus connector
Standoff mounting holes
Standoff mounting holes
Port adapter securing screw
Port adapter securing screw
PA-H port adapter in slot 0
Port adapter blank in slot 1
26799
Port adapter handles not shown
Front mounting hole (hidden from view)
Front mounting hole (hidden from view)

Note Port adapters have a handle attached, but this handle is not shown to allow a full view of detail on each port adapter's faceplate.

Depending on the circumstances, you might need to install a new port adapter on a Catalyst RSM/VIP2 motherboard or replace a failed port adapter in the field. In either case, you will need the following items:

- Number 1 Phillips screwdriver
- Antistatic mat onto which you can place the removed interface processor
- Antistatic container into which you can place a failed port adapter for shipment back to the factory

Caution To prevent system problems, do not remove port adapters from the Catalyst RSM/VIP2 motherboard, or attempt to install other port adapters on the Catalyst RSM/VIP2 motherboard while the system is operating. To install or replace port adapters, first remove the Catalyst RSM/VIP2 from its interface processor slot.

Note Each port adapter circuit board is mounted to a metal carrier and is sensitive to ESD damage. Each port adapter has one Phillips-head screw that secures it to its port adapter slot. We strongly recommend that the following procedures be performed by a Cisco-certified service provider; however, this is not a requirement.

While the Catalyst RSM/VIP2 supports online insertion and removal (OIR), individual port adapters do not. To replace port adapters, you must first remove the Catalyst RSM/VIP2 from the chassis, and then install or replace port adapters as required. If a blank port adapter is installed on the Catalyst RSM/VIP2 in which you want to install a new port adapter, you must first remove the Catalyst RSM/VIP2 from the chassis, and then remove the blank port adapter.

When only one port adapter is installed on a Catalyst RSM/VIP2, a blank port adapter must fill the empty slot to allow the Catalyst RSM/VIP2 to conform to electromagnetic interference (EMI) emissions requirements, and so that air flows through the chassis properly. If you plan to install a new port adapter, you must first remove the blank port adapter.

Note The BABT605559 marking on the PA-H (see Figure 1-2) signifies that the port adapter meets United Kingdom directive 605559 and has been designed to BABT/TC/130 standards.

Use the following standard procedure to remove and replace any type of port adapter on a Catalyst RSM/VIP2:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Note To install a new port adapter on a Catalyst RSM/VIP2 with a single port adapter, you must first remove the blank port adapter from the port adapter slot in which you want to install the new port adapter.

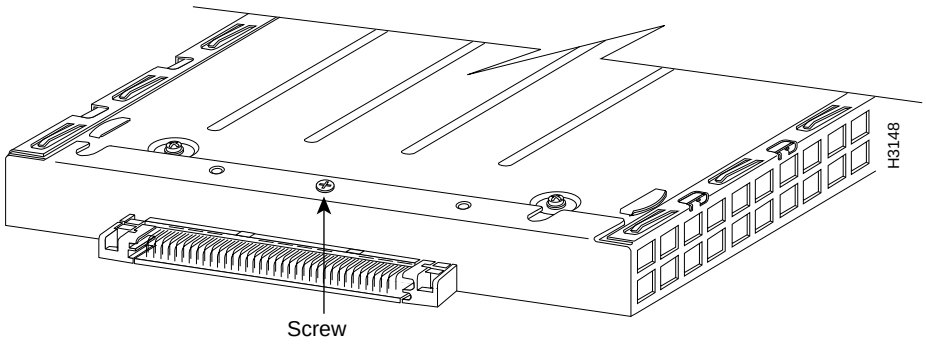
Step 2 For a new port adapter installation or a port adapter replacement, disconnect any interface cables from the ports on the front of the port adapter, although this is not required. You can remove Catalyst RSM/VIP2 with cables attached; however, we do not recommend it.

Step 3 Remove the Catalyst RSM/VIP2 from the system. Follow the steps in the *Route Switch Module Catalyst VIP2-15 and VIP2-40 Installation and Configuration Note* (Document Number 78-4780-01) which shipped with your Catalyst RSM/VIP2.

Step 4 Place the removed Catalyst RSM/VIP2 on an antistatic mat.

Step 5 Locate the screw at the rear of the port adapter (or blank port adapter) to be replaced. (See Figure 4-2.) This screw secures the port adapter (or blank port adapter) to its slot.

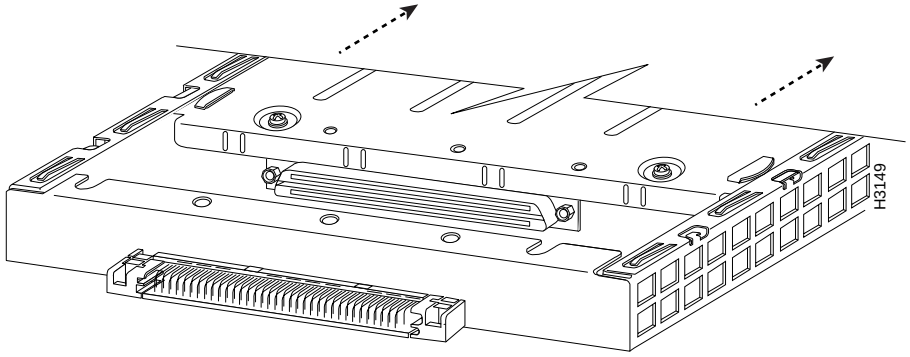
Figure 4-2 Location of Port Adapter Screw—Partial Port Adapter View



Step 6 Remove the screw that secures the port adapter (or blank port adapter).

Step 7 With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See Figure 4-3.)

Figure 4-3 Pulling a Port Adapter Out of a Slot—Partial Port Adapter View

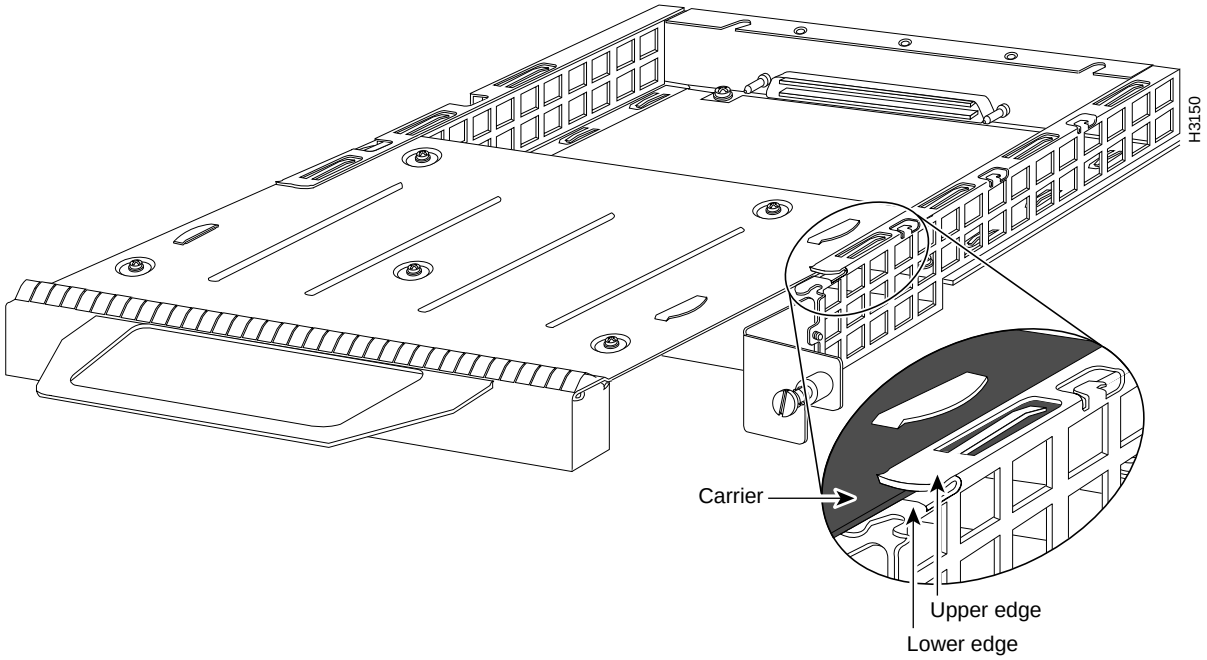


Step 8 If you removed a port adapter, place it in an antistatic container for safe storage or shipment back to the factory. If you removed a blank port adapter, no special handling is required; however, store the blank port adapter for potential future use.

Step 9 Remove the new port adapter from its antistatic container and position it at the opening of the slot. (See Figure 4-4.)

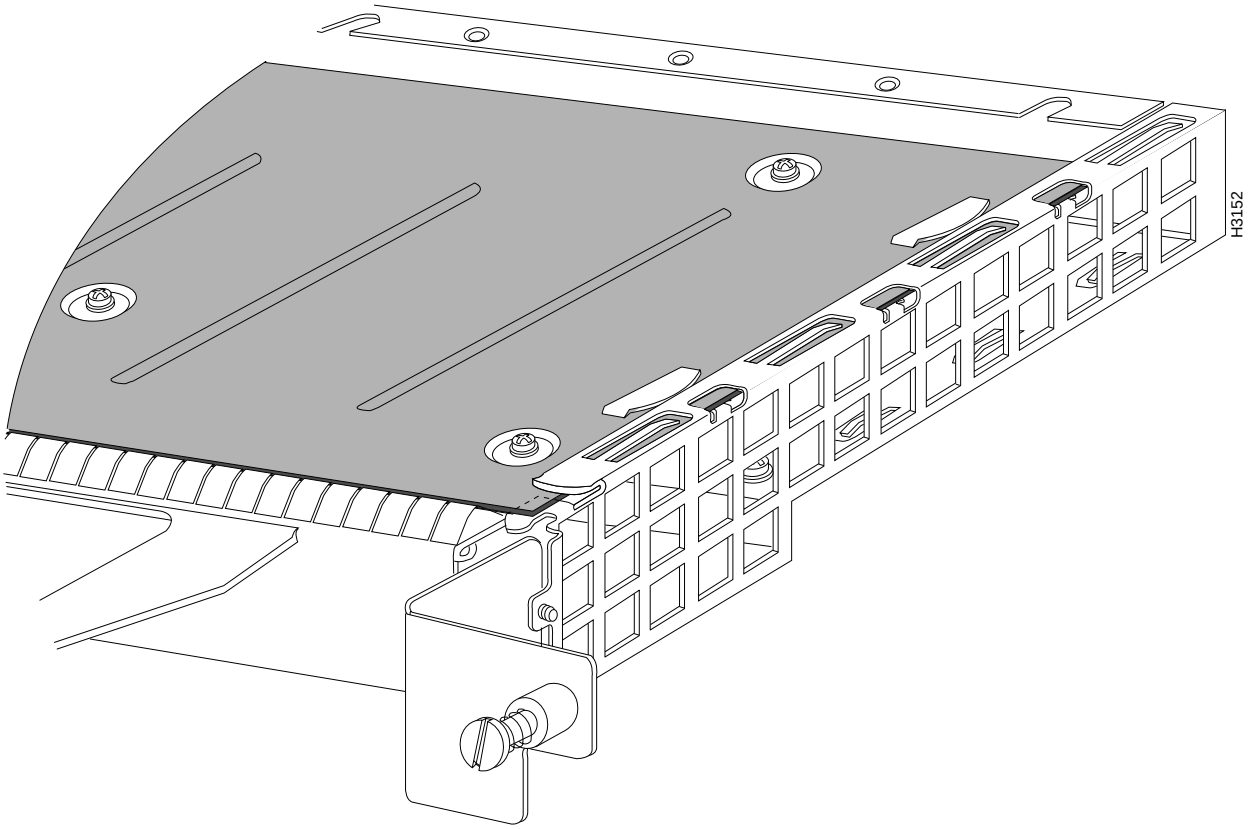
Caution To prevent jamming the carrier between the upper and lower edges of the port adapter slot, and to assure that the edge connector at the rear of the port adapter mates with the connector at the rear of the port adapter slot, make certain that the leading edges of the carrier are between the upper and lower slot edges, as shown in the cutaway in Figure 4-4.

Figure 4-4 Aligning a Port Adapter in a Port Adapter Slot



Step 10 Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely mated with the connector on the motherboard (see Figure 4-5).

Figure 4-5 Port Adapter Installed in a Port Adapter Slot—Partial Port Adapter View



Step 11 Replace the screw in the rear of the port adapter slot. (See Figure 4-2 for its location.) Do not overtighten this screw.

Step 12 Reinstall the Catalyst RSM/VIP2 in the system. Follow the steps in the *Route Switch Module Catalyst VIP2-15 and VIP2-40 Installation and Configuration Note* (Document Number 78-4780-01) which shipped with your Catalyst RSM/VIP2.

Step 13 If disconnected, reconnect the interface cables to the port adapters.

This completes the procedure for installing a new port adapter or replacing a port adapter on a Catalyst RSM/VIP2. To install the necessary cables and configure your PA-H, proceed to Chapter 8, “Cable Installation and Interface Configuration.”

Cisco 7200 Series and the PA-H HSSI Port Adapter

This chapter provides information on the PA-H HSSI port adapter and its use on Cisco 7200 series routers. This chapter contains the following sections:

- Installation Overview, page 5-1
- Removing a Port Adapter, page 5-2
- Installing a Port Adapter, page 5-3

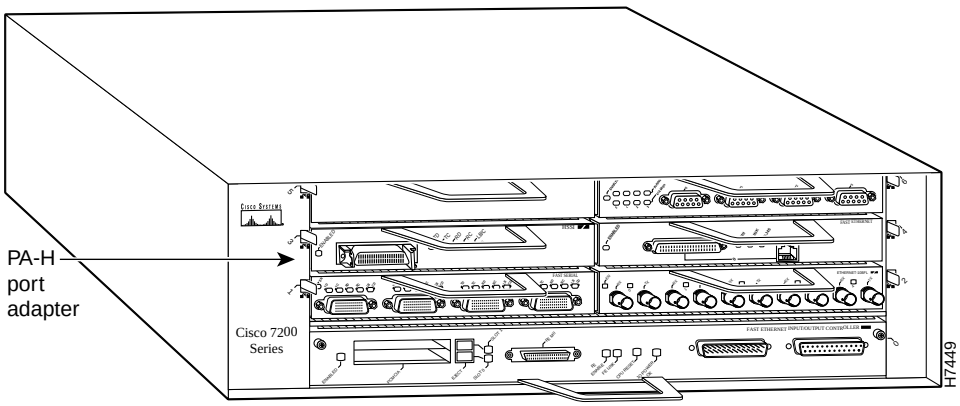
Installation Overview

The PA-H is used in the Cisco 7200 series routers (which includes the Cisco 7206 as a router shelf in a Cisco AS5800 Universal Access Server) and can be installed in any of the available port adapter slots. Figure 5-1 shows a PA-H installed in port adapter slot 3 of a Cisco 7206.

Note The steps for installing and configuring a port adapter or service adapter in a Cisco 7200 series router and a Cisco 7206 router shelf are the same; therefore, the procedures in this section apply to the Cisco 7206 router shelf, unless noted otherwise.

For information about the Cisco 7206 as a router shelf in a Cisco AS5800 Universal Access Server, refer to the Cisco AS5800 Universal Access Server documentation listed in the "Related Documentation" section on page vi.

Figure 5-1 Cisco 7206 with a PA-H in Port Adapter Slot 3



Depending on your circumstances, you might need to install a new port adapter in a Cisco 7200 series router or replace a failed port adapter in the field. In either case, no tools are necessary; all port adapters available for the Cisco 7200 series connect directly to the router midplane and are locked into position by a port adapter lever. When removing and replacing a port adapter, you will need an antistatic mat onto which you can place a removed port adapter and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

Note The Cisco 7200 series routers support online insertion and removal (OIR); therefore, you do not have to power down the Cisco 7200 series routers when removing and replacing a HSSI port adapter.

When a port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to EMI emissions requirements and to allow proper air flow across the port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove a blank port adapter.

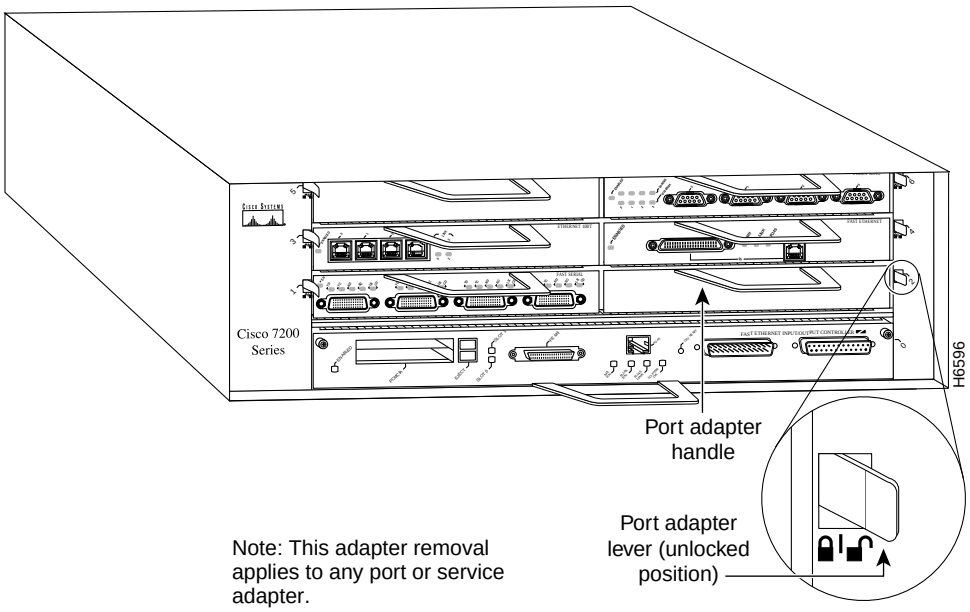
Removing a Port Adapter

Use the following procedure to remove a port adapter from a Cisco 7200 series router:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 2 Place the port adapter lever for the desired port adapter slot in the unlocked position. The lever remains in the unlocked position. (See Figure 5-2.)

Figure 5-2 Placing the Port Adapter Lever in the Unlocked Position—Cisco 7206



Step 3 Grasp the handle on the port adapter and pull the port adapter from the midplane, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the port adapter slot.

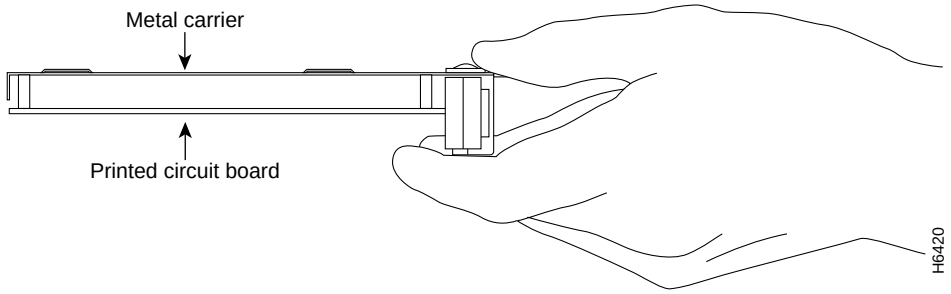
Note As you disengage the port adapter from the router midplane, OIR administratively shuts down all active interfaces on the port adapter.

Step 4 With the port adapter halfway out of the slot, disconnect all cables from the port adapter.

Step 5 After disconnecting the cables, pull the port adapter from its port adapter slot.

Caution Always handle the port adapter by the carrier edges and handle; never touch the port adapter's components or connector pins. (See Figure 5-3.)

Figure 5-3 Handling a Port Adapter



Step 6 Place the port adapter on an antistatic surface with its components facing upward, or in a static shielding bag. If the port adapter will be returned to the factory, immediately place it in a static shielding bag.

This completes the procedure for removing a port adapter from a Cisco 7200 series router.

Installing a Port Adapter

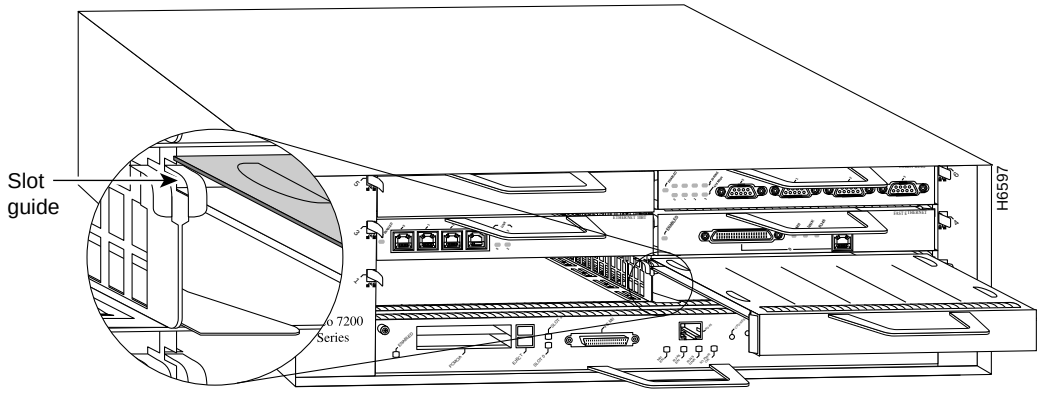
Use the following procedure to install a new port adapter in a Cisco 7200 series router:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 2 Use both hands to grasp the port adapter by its metal carrier edges and position the port adapter so that its components face downward. (See Figure 5-3.)

Step 3 Align the left and right edge of the port adapter metal carrier between the guides in the port adapter slot. (See Figure 5-4.)

Figure 5-4 Aligning the Port Adapter Metal Carrier Between the Slot Guides—Cisco 7206



Note: This adapter alignment applies to any port or service adapter.

Step 4 With the metal carrier aligned in the slot guides, gently slide the port adapter halfway into the slot.

Caution Do not slide the port adapter all the way into the slot until you have connected all required cables. Trying to do so will disrupt normal operation of the router.

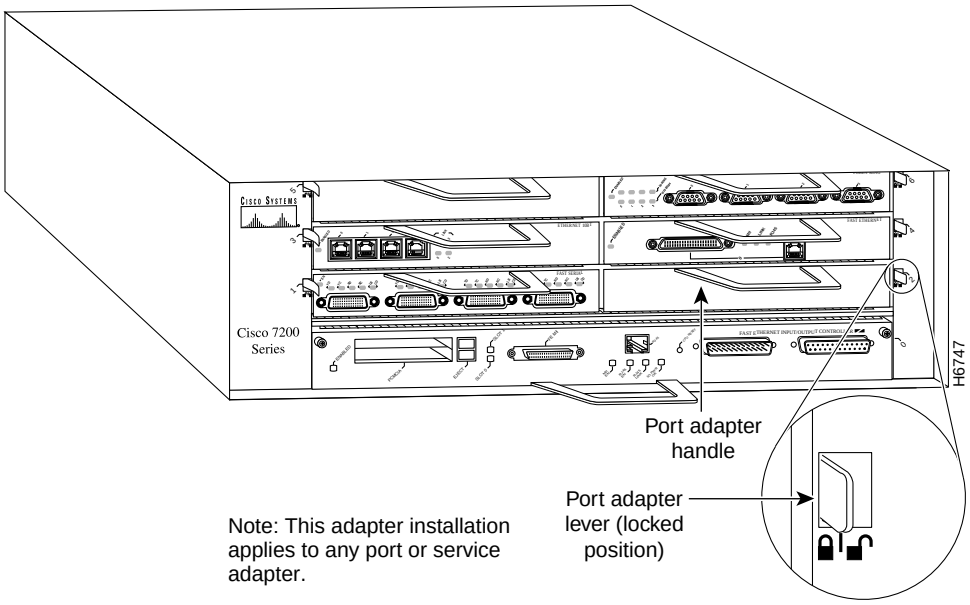
Step 5 With the port adapter halfway in the slot, connect all required cables to the port adapter.

Step 6 After connecting the cables, carefully slide the port adapter all the way into the slot until you feel the port adapter's connectors seat in the midplane.

Step 7 Move the port adapter lever to the locked position. Figure 5-5 shows the lever in the locked position.

Note If the lever does not move to the locked position, the port adapter is not completely seated in the midplane. Carefully pull the port adapter halfway out of the slot, reinsert it, and move the port adapter lever to the locked position.

Figure 5-5 Placing the Port Adapter Lever in the Locked Position—Cisco 7206



This completes the procedure for installing a new port adapter or replacing a port adapter in a Cisco 7200 series router. To install the necessary cables and configure your PA-H, proceed to Chapter 8, “Cable Installation and Interface Configuration.”

Cisco uBR7200 Series and the PA-H HSSI Port Adapter

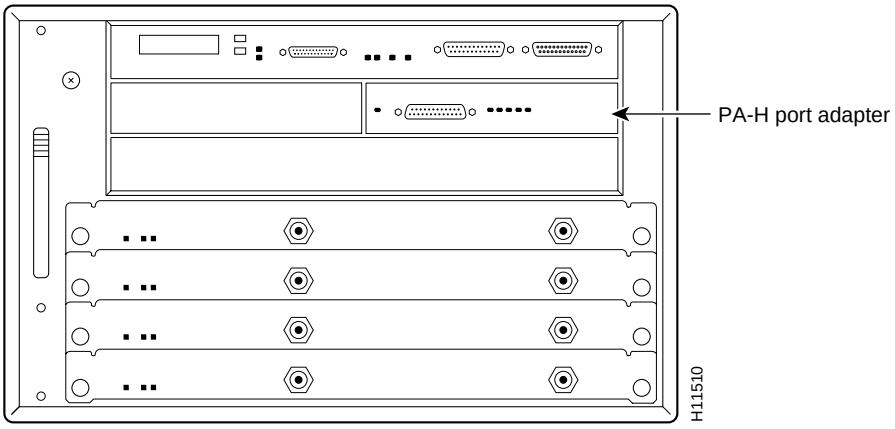
This chapter provides information on the PA-H HSSI port adapter and its use on Cisco uBR7200 series universal broadband routers. This chapter contains the following sections:

- Installation Overview, page 6-1
- Removing a Port Adapter, page 6-2
- Installing a Port Adapter, page 6-4

Installation Overview

The PA-H is used in Cisco uBR7200 series routers and can be installed in any of the available port adapter slots. Figure 6-1 shows a PA-H installed in port adapter slot 2 of a Cisco uBR7200 series router.

Figure 6-1 Cisco uBR7200 Series with a PA-H in Port Adapter Slot 2—Cisco uBR7246



Depending on your circumstances, you might need to install a new port adapter in a Cisco uBR7200 series universal broadband router or replace a failed port adapter in the field. In either case, no tools are necessary; all port adapters available for Cisco uBR7200 series routers connect directly to the router midplane and are locked into position by a port adapter retention clip (Cisco uBR7246) or lever (Cisco uBR7223). When removing and replacing a port adapter, you will need an antistatic mat onto which you can place a removed port adapter and an antistatic container into which you can place a failed port adapter for shipment back to the factory.

Note The Cisco uBR7200 series universal broadband routers support online insertion and removal (OIR); therefore, you do not have to power down the Cisco uBR7200 series universal broadband router when removing and replacing a PA-H.

When a port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to EMI emissions requirements and to allow proper air flow across the port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove a blank port adapter.

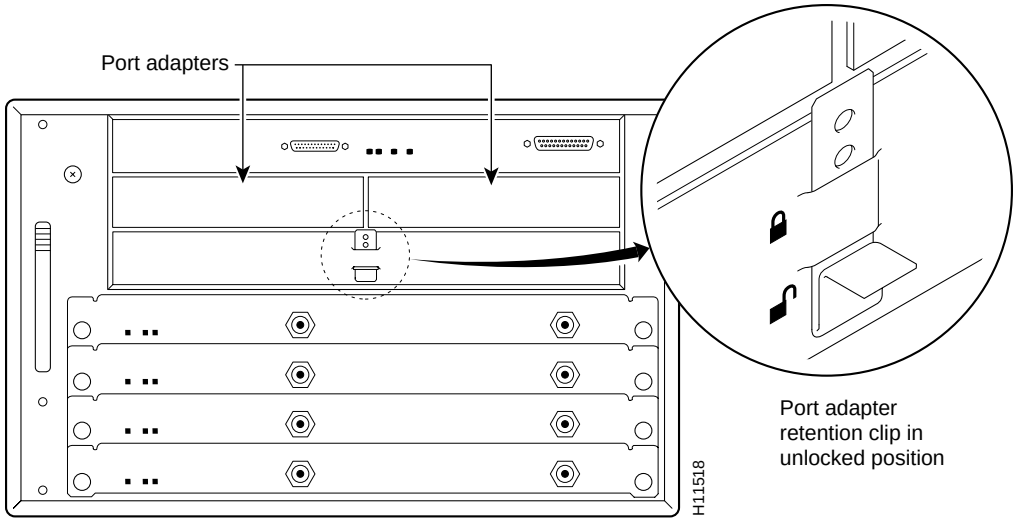
Removing a Port Adapter

Take the following steps to remove a port adapter from Cisco uBR7200 series universal broadband routers:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

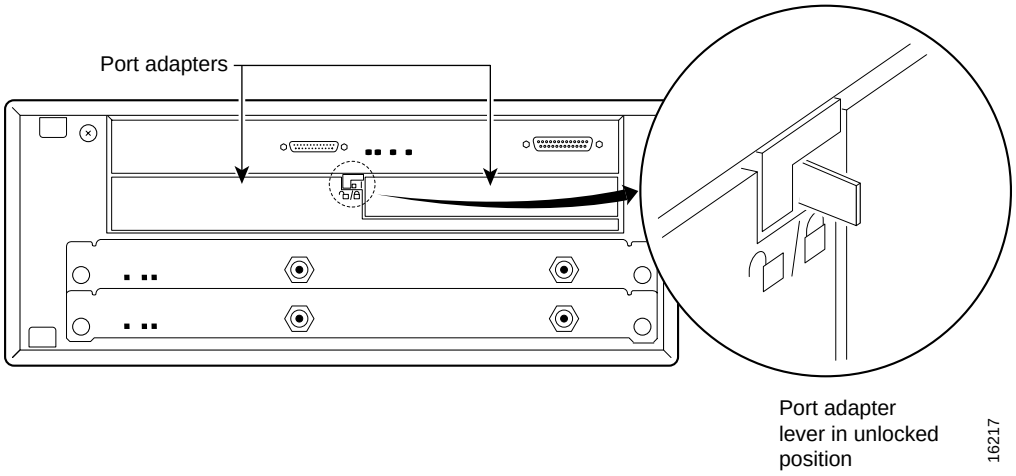
Step 2 For the Cisco uBR7246, slide the port adapter retention clip down to the unlocked position. The retention clip remains in the unlocked position. (See Figure 6-2.)

Figure 6-2 Placing the Port Adapter Retention Clip in the Unlocked Position—Cisco uBR7246



For the Cisco uBR7223, place the port adapter lever in the unlocked position. (See Figure 6-3.)

Figure 6-3 Placing the Port Adapter Lever in the Unlocked Position—Cisco uBR7223



Step 3 Grasp the handle on the port adapter and pull the port adapter from the midplane, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

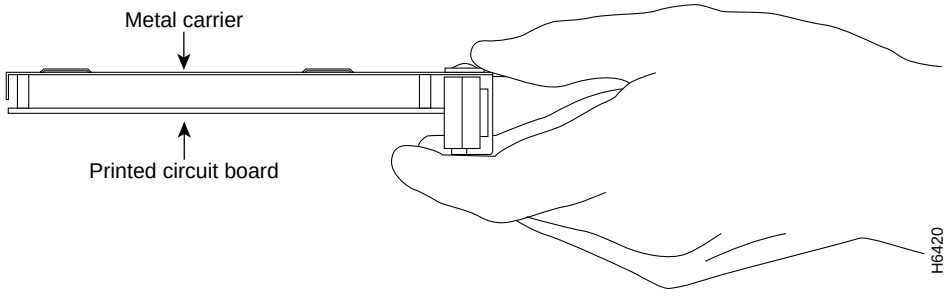
Note As you disengage the port adapter from the router midplane, OIR administratively shuts down all active interfaces on the port adapter.

Step 4 With the port adapter halfway out of the slot, disconnect all cables from the port adapter.

Step 5 After disconnecting the cables, pull the port adapter from its chassis slot.

Caution Always handle the port adapter by the carrier edges and handle; never touch the port adapter's components or connector pins. (See Figure 6-4.)

Figure 6-4 Handling a Port Adapter



Step 6 Place the port adapter on an antistatic surface with its components facing upward, or in a static shielding bag. If the port adapter will be returned to the factory, immediately place it in a static shielding bag.

This completes the procedure for removing a port adapter from a Cisco uBR7200 series universal broadband router.

Installing a Port Adapter

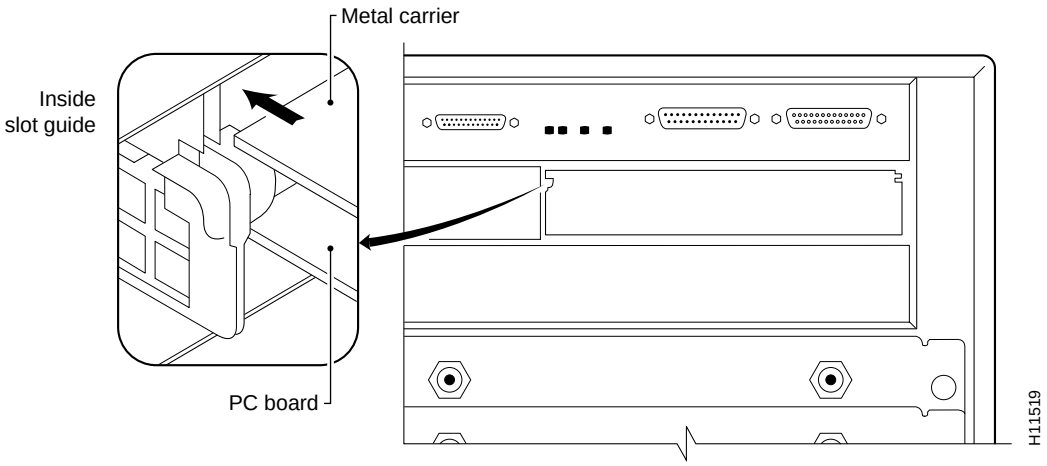
Use the following procedure to install a new port adapter in a Cisco uBR7200 series universal broadband router:

Step 1 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 2 Use both hands to grasp the port adapter by its metal carrier edges and position the port adapter so that its components face downward. (See Figure 6-4.)

Step 3 Align the left and right edge of the port adapter metal carrier between the guides in the port adapter slot. (See Figure 6-5.)

Figure 6-5 Aligning the Port Adapter Metal Carrier Between the Slot Guides



Step 4 With the metal carrier aligned in the slot guides, gently slide the port adapter halfway into the slot.

Caution Do not slide the port adapter all the way into the slot until you have connected all required cables. Trying to do so will disrupt normal operation of the router.

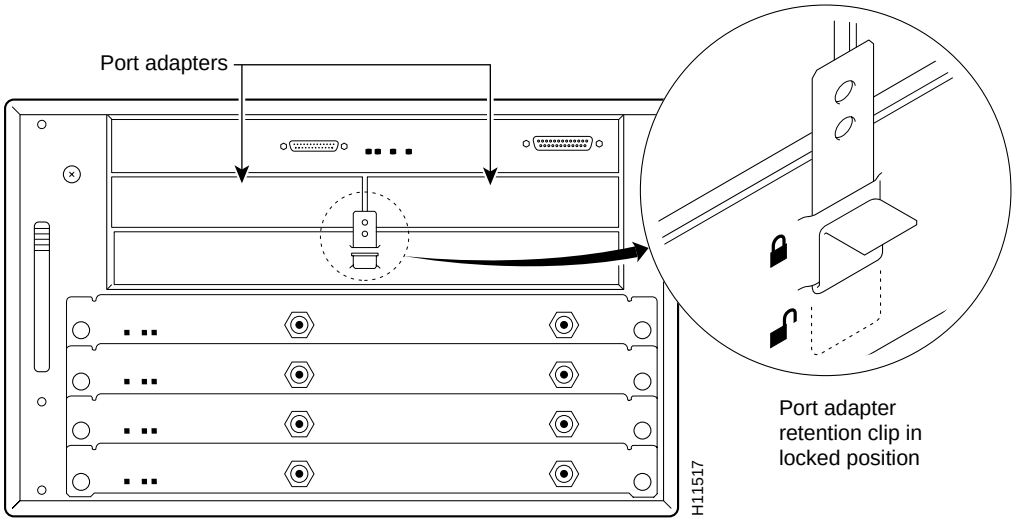
Step 5 With the port adapter halfway in the slot, connect all required cables to the port adapter.

Step 6 After connecting the cables, carefully slide the port adapter all the way into the slot until you feel the port adapter's connectors seat in the midplane.

Step 7 For the Cisco uBR7246, after the two connectors mate, slide the port adapter retention clip up to the locked position. Figure 6-6 shows the retention clip in the locked position.

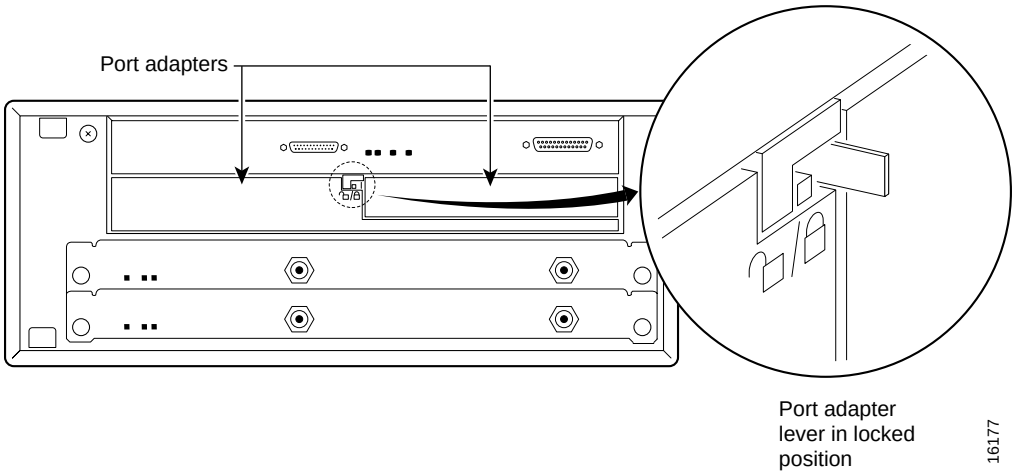
Note If the retention clip does not slide up to the locked position, the port adapter is not completely seated in the midplane. Slide the retention clip completely down to the unlocked position. Carefully pull the port adapter halfway out of the slot, reinsert it, and slide the retention clip up to the locked position.

Figure 6-6 Placing the Port Adapter Retention Clip in the Locked Position—Cisco uBR7246



For a Cisco uBR7223, place the port adapter lever in the locked position. (See Figure 6-7.)

Figure 6-7 Placing the Port Adapter Lever in the Locked Position—Cisco uBR7223



Note If the port adapter lever does not move to the locked position, the port adapter is not completely seated in the midplane. Carefully pull the port adapter halfway out of the slot, reinsert it, and move the port adapter lever to the locked position.

This completes the procedure for installing a new port adapter or replacing a port adapter in a Cisco uBR7200 series universal broadband router. To install the necessary cables and configure your PA-H, proceed to “Chapter 8, “Cable Installation and Interface Configuration.”

Cisco 7100 Series and the PA-H HSSI Port Adapter

This chapter provides information on the PA-H and its use in the Cisco 7100 series routers. This chapter contains the following sections:

- Installation Overview, page 7-1
- Removing a Port Adapter, page 7-2
- Installing a Port Adapter, page 7-3

Installation Overview

The PA-H can be installed in port adapter slot 3 in the Cisco 7120 series, and in port adapter slot 4 in the Cisco 7140 series. Figure 7-1 shows port adapter slot 3 of a Cisco 7120 Series router. Figure 7-2 shows port adapter slot 4 of a Cisco 7140 series router.

Figure 7-1 Cisco 7120 Series Router—Port Adapter Slot 3 Location

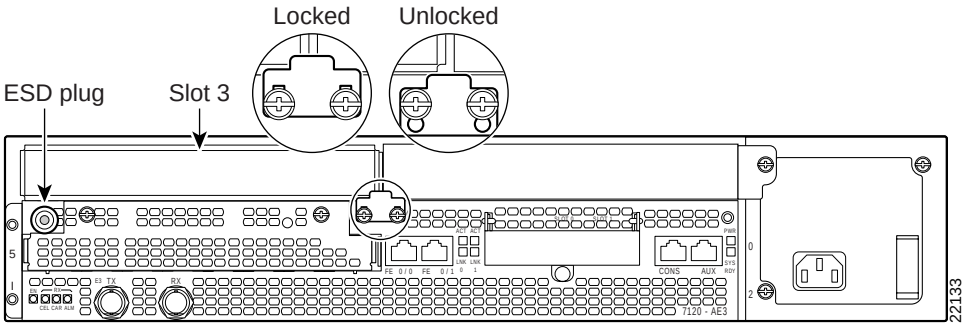
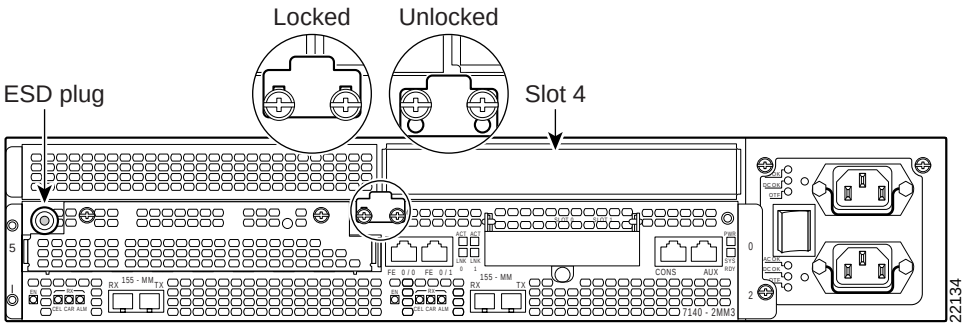


Figure 7-2 Cisco 7100 Series Router—Port Adapter Slot 4 Location



Depending on your circumstances, you might need to install a new port adapter in a Cisco 7100 series router or replace a failed port adapter in the field. All port adapters available for the Cisco 7100 series connect directly to the router and are locked into position by a locking tab with two screws (see Figure 7-1 or Figure 7-2). You need a number 2 Phillips screwdriver to loosen the screws.

Note The Cisco 7100 series routers support online insertion and removal (OIR); therefore, you do not have to power down the router when removing and replacing a port adapter.

When a port adapter slot is not in use, a blank port adapter must fill the empty slot to allow the router to conform to EMI emissions requirements and to allow proper airflow across the port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove a blank port adapter.

Removing a Port Adapter

Follow these steps to remove a port adapter from a Cisco 7100 series router:

Step 1 Attach an ESD-preventive wrist strap between you and the chassis. (See Figure 7-1 or Figure 7-2 for the location of the ESD plug.)

Step 2 Use a number 2 Phillips screwdriver to loosen the screws on the locking tab; then slide the tab down to the unlocked position. (See Figure 7-1 or Figure 7-2.)

Step 3 Grasp the handle on the port adapter and pull the port adapter from the router, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

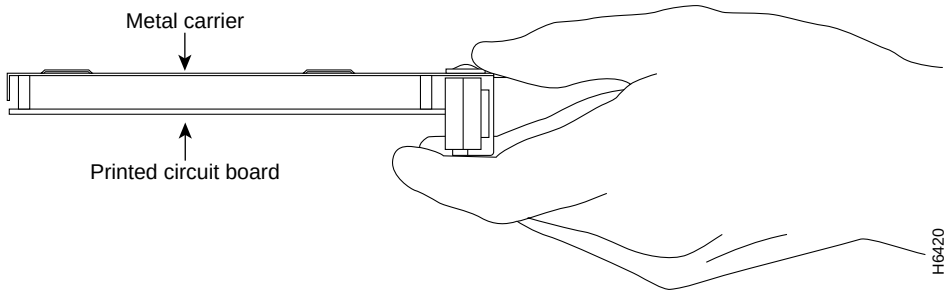
Note As you disengage the port adapter from the router, OIR administratively shuts down all active interfaces on the port adapter.

Step 4 With the port adapter halfway out of the slot, disconnect all cables from the port adapter.

Step 5 After disconnecting the cables, pull the port adapter from its chassis slot.

Caution Always handle the port adapter by the carrier edges and handle; never touch the port adapter's components or connector pins. (See Figure 7-3.)

Figure 7-3 Handling a Port Adapter



Step 6 Place the port adapter on an antistatic surface with its components facing upward, or in a static shielding bag. If the port adapter will be returned to the factory, immediately place it in a static shielding bag.

Step 7 Install a blank port adapter or replacement port adapter to maintain proper flow of cooling air across the internal components. For procedures on how to install a port adapter, see the next section "Installing a Port Adapter."

Note The blank port adapter is available from Cisco Systems as a spare. The blank port adapter product number is MAS-7100-PABLANK.

This completes the procedure for removing a port adapter from a Cisco 7100 series router.

Installing a Port Adapter

Take the following steps to install a new port adapter in a Cisco 7100 series router:

Step 1 Attach an ESD-preventive wrist strap between you and the chassis. (See Figure 7-1 or 6-2 for the location of the ESD plug.)

Step 2 Ensure that the locking tab is down in the unlocked position. If it is locked, use a number 2 Phillips screwdriver to loosen the screws; then slide the tab down to the unlocked position. (See Figure 7-1 or 6-2.)

Step 3 Remove the new port adapter from its antistatic container and position it at the opening of the slot.

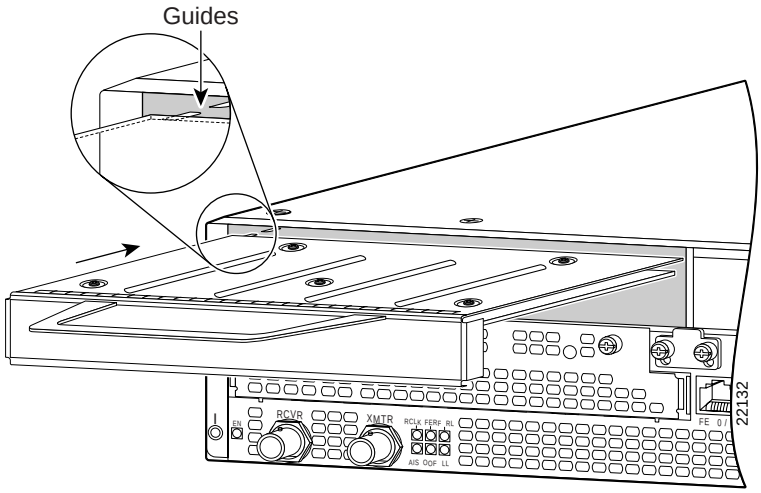
Step 4 Use both hands to grasp the port adapter by its metal carrier edges, and position the port adapter so that its components face downward. (See Figure 7-3.)

Step 5 Align the left and right edge of the port adapter metal carrier between the guides in the port adapter slot. (See Figure 7-4.)

Step 6 With the metal carrier aligned in the slot guides, gently slide the port adapter halfway into the slot.

Caution Do not slide the port adapter all the way into the slot until you have connected all required cables. Trying to do so disrupts normal operation of the router.

Figure 7-4 Aligning the Single-Width Port Adapter Between the Slot Guides



Step 7 With the port adapter halfway in the slot, connect all required cables to the port adapter.

Step 8 After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router.

Step 9 After seating the port adapter in the router, slide the locking tab up to the locked position and tighten the screws. (Figure 7-1 or Figure 7-2 shows the locking tab in the locked position.)

This completes the procedure for installing a new port adapter in a Cisco 7100 series router. Proceed to Chapter 8, “Cable Installation and Interface Configuration,” for information on how to configure your port adapter.

Cable Installation and Interface Configuration

To continue your PA-H HSSI port adapter installation, you must install the port adapter cables and configure the HSSI interfaces. The instructions that follow apply to all supported platforms. Minor differences between the platforms are noted. This chapter contains the following sections:

- Attaching PA-H HSSI Port Adapter Interface Cables, page 8-1
- Attaching a Null Modem Cable to PA-H HSSI Port Adapters, page 8-2
- Configuring the HSSI Interfaces, page 8-3

Attaching PA-H HSSI Port Adapter Interface Cables

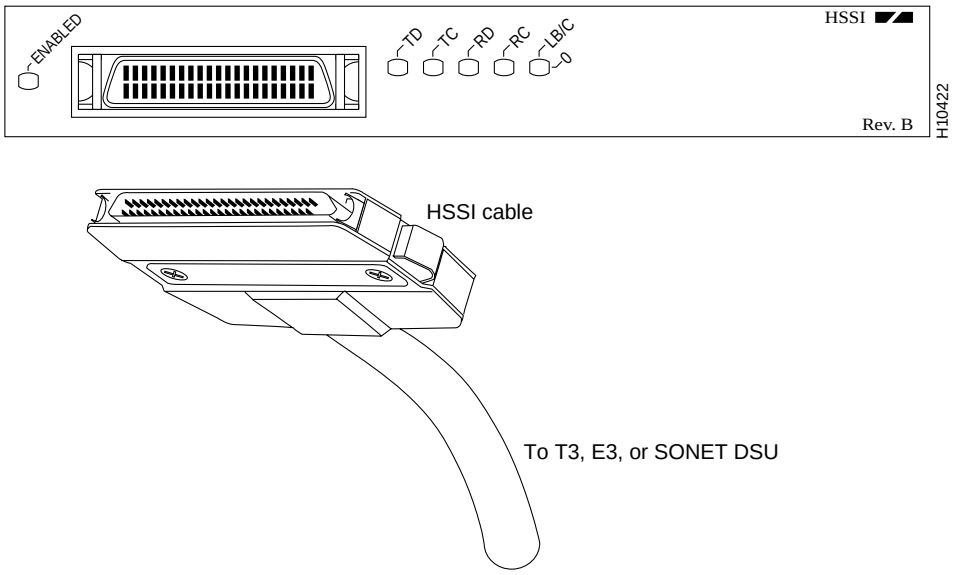
On a single PA-H, you can use one HSSI connection. HSSI cables are available from Cisco Systems; they are *not* available from outside commercial cable vendors.

Caution Although the HSSI connector and the HSSI cable are similar to the SCSI-II format, they are not identical. The HSSI cable specification is more stringent than that for the SCSI-II. If you use a SCSI-II cable instead of an HSSI cable, proper operation cannot be guaranteed.

Connect HSSI cables to a PA-H as follows:

Step 1 Attach the HSSI cable directly to the PA-H HSSI port on the PA-H. (See Figure 8-1.)

Figure 8-1 Connecting HSSI Cables



Note Port adapters have a handle attached, but it is not shown in Figure 8-1 to allow a full view of the detail on each port adapter's faceplate.

Step 2 Attach the network end of your HSSI cable to your T3 or E3 DSU or to other external HSSI equipment.

Attaching a Null Modem Cable to PA-H HSSI Port Adapters

The null modem cable can connect two routers directly back to back. The two routers must be in the same location, and can be two Cisco 7000 series routers, two Cisco 7500 series routers, two Cisco 7200 series routers, two Cisco uBR7200 series universal broadband routers, two Cisco 7100 series routers, or one of each. This setup allows you to verify the operation of the HSSI or to directly link the routers to build a larger node. The null modem cable uses the same 50-pin connectors as the HSSI cable, but uses the pinouts listed in Table 1-3 on page 1-9.

To connect two routers, attach a null modem cable between a HSSI port on each router. Enable the internal transmit clock in both routers by entering the command **hssi internal-clock**. All router platforms use the same **hssi internal-clock** command to enable the internal transmit clock on the HSSI.

You define Cisco 7000 series and Cisco 7500 series interfaces by type and physical slot/port adapter/port locations. You define Cisco 7200 series, Cisco uBR7200 series, and Cisco 7100 series interfaces by type and port adapter slot number/port locations. You define the Catalyst RSM/VIP2 in the Catalyst 5000 family switches. (The output of the **show interfaces** command displays the logical unit number on all supported platforms and the physical slot/port adapter/port location in Cisco 7000 series and Cisco 7500 series router, or the port adapter slot number/port location in Cisco 7200 series, Cisco uBR7200 series, Cisco 7100 series routers, and the Catalyst RSM/VIP2.)

Note In the Cisco 7206 and Cisco 7206VXR router shelves, you define interfaces by type and physical shelf/port adapter/port locations. For information on Cisco 7206 and Cisco 7206VXR router shelf physical port addresses, see the "Identifying Chassis Slot, Port Adapter Slot, and HSSI Interface Port Numbers" section on page 8-4.

The following examples show the configuration commands needed to prepare Cisco 7000 series, Cisco 7200 series, Cisco 7500 series, Cisco uBR7200 series, and Cisco 7100 series routers for a null modem cable connection:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#

Enter configuration commands...
```

For Cisco 7000 series and Cisco 7500 series:

```
Router(config)# interface hssi 1/0/0
Router(config-int)# hssi internal-clock
Router(config-int)# ^z
```

For Catalyst RSM/VIP2:

```
Router(config)# interface hssi 0/0
Router(config-int)# hssi internal-clock
Router(config-int)# ^z
```

For Cisco 7200 series, Cisco 7100 series and Cisco uBR7200 series:

```
Router(config)# interface hssi 1/0
Router(config-int)# hssi internal-clock
Router(config-int)# ^z
```

Note For the Cisco 7206 and Cisco 7206VXR router shelves, the interface specified in the Cisco 7200 series example above would include a shelf number. For example, the command **interface hssi 5/1/0** would specify the first HSSI interface of the port adapter in slot 1 of Cisco 7206 or Cisco 7206VXR router shelf 5.

Be sure to configure the HSSI port on both routers for an internal transmit clock. When the internal clock is enabled, the TC LED on the PA-H goes on. When the internal clock is enabled in both routers, the TC and RC LEDs on both of the connected HSSI ports go on.

When you disconnect the null modem cable, you must also disable the internal transmit clock with the command **no hssi internal-clock**. Use this command to turn off the transmit clock for each port on both routers.

This completes the procedure for attaching a null modem cable to your PA-H. Proceed to the next section "Configuring the HSSI Interfaces."

Configuring the HSSI Interfaces

If you installed a new PA-H or if you want to change the configuration of an existing interface, you must enter configuration mode using the **configure** command. If you replaced a PA-H that was previously configured, the system will recognize each new HSSI and bring it up in its existing configuration.

After you verify that the new PA-H is installed correctly (the enabled LED goes on), use the privileged-level **configure** command to configure the new interfaces. Be prepared with the information you will need, such as the following:

- Protocols you plan to route on each new interface
- IP addresses if you plan to configure the interfaces for IP routing
- Whether the new interfaces will use bridging

For a summary of the configuration options available, refer to the appropriate configuration publications listed in the "Related Documentation" section on page vi.

The **configure** command requires privileged-level access to the EXEC command interpreter, which usually requires a password. Contact your system administrator if necessary to obtain EXEC-level access.

Identifying Chassis Slot, Port Adapter Slot, and HSSI Interface Port Numbers

The following sections describes how to identify the chassis slot, port adapter slot, and HSSI interface port numbers for the Cisco 7200 series, Cisco uBR7200 series universal broadband routers, Cisco 7100 series routers, the VIP2, and the Catalyst RSM/VIP2.

Cisco 7200 Series and Cisco uBR7200 Series Ports

In a Cisco 7200 series or Cisco uBR7200 series router, physical port addresses specify the actual physical location of each interface port on the router. This address is composed of a two-part number in the format *port adapter slot number/interface port number*, as follows:

- The first number identifies the port adapter slot in which the HSSI port adapter is installed.
- The second number identifies the interface port on the HSSI port adapter; always numbered as interface 0 for PA-H.

Note For the Cisco 7206 and Cisco 7206VXR router shelves, physical port addresses are composed of a three-part number in the format *shelf number/port adapter slot number/interface port number*, where the *shelf number* is a number assigned to the Cisco 7206 or Cisco 7206VXR router shelf during the initial configuration of the Cisco AS5800 Universal Access Server. A Cisco AS5800 Universal Access Server can consist of several shelves; therefore, each shelf is assigned a shelf number.

Interface ports maintain the same address regardless of whether other port adapters are installed or removed from the slot. However, when you move a port adapter to a different slot, the port adapter slot number in the address changes to reflect the new slot number.

For the Cisco 7206 (including a Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server), the port adapter slot numbers start with 1 and continue through 6. For the Cisco uBR7200 series routers, the port adapter slots are numbered 1 and 2 for the Cisco uBR7246 and slot 1 for the Cisco uBR7223 (slot 0 is always reserved for the Fast Ethernet port on the I/O controller—if present). The individual interface port numbers are always 0. For example, the HSSI port on a PA-H port adapter in port adapter slot 2 would have the address 2/0. If the PA-H was in port adapter slot 1, this same interface port would be 1/0.

Note For the Cisco 7206 and Cisco 7206VXR router shelves, the PA-H in port adapter slot 2 would have the address *x*/2/0, where *x* is the number assigned to the router shelf during the initial configuration of the Cisco AS5800 Universal Access Server.

VIP2 Ports

In VIP2s in Cisco 7000 series and Cisco 7500 series routers, physical port addresses specify the actual physical location of each interface port on the router interface processor end. This address is composed of a three-part number in the format *interface processor slot/port-adapter/interface port*, as follows:

- The first number identifies the interface processor slot in which the VIP2 is installed.
- The second number identifies the physical port adapter slot on the VIP2, and is either 0 or 1.
- The third number identifies the interface port on the HSSI port adapter, which is always numbered as interface 0 for PA-H.

Note Although the processor slots in the 7-slot Cisco 7000 and Cisco 7507 and 13-slot Cisco 7513 are vertically oriented and those in the 5-slot Cisco 7010 and Cisco 7505 are horizontally oriented, all models use the same method for slot and port numbering.

Interface ports on the VIP2 maintain the same address regardless of whether other interface processors are installed or removed. However, when you move a VIP2 to a different slot, the first number in the address changes to reflect the new interface processor slot number.

On the VIP2, the first port adapter slot number is always 0. The second port adapter slot number is always 1. The individual interface port numbers are always 0.

You can also identify interface ports by physically checking the slot/port-adapter/interface port location on the back of the router or by using **show** commands to display information about a specific interface or all interfaces in the router.

Catalyst RSM/VIP2 Ports

In the Catalyst RSM/VIP2, the address is composed of a two-part number in the format *port-adapter/interface port*, as follows:

- The first number identifies the physical port adapter slot on the Catalyst RSM/VIP2, and is either 0 or 1.
- The second number identifies the interface port on the HSSI port adapter, which is always numbered as interface 0 for PA-H.

Interface ports on the Catalyst RSM/VIP2 maintain the same address regardless of whether other interface processors are installed or removed.

On the Catalyst RSM/VIP2, the first port adapter slot number is always 0. The second port adapter slot number is always 1. The individual interface port numbers are always 0.

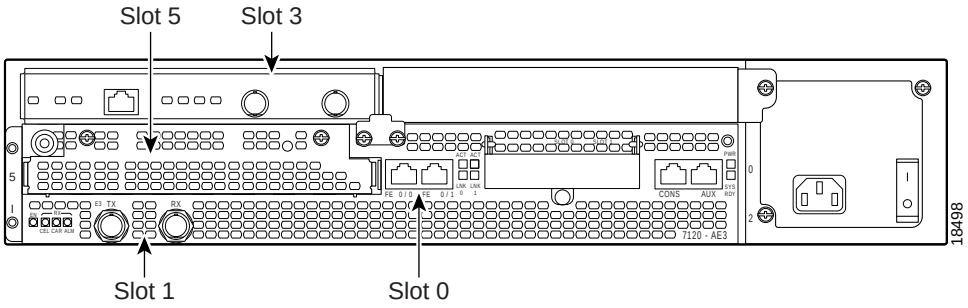
You can also identify interface ports by physically checking the port-adapter/interface port location or by using **show** commands to display information about a specific interface.

Cisco 7100 Series Ports

In the Cisco 7100 series routers, the *slot number* is the location in the chassis where the interface resides and the *port number* is the physical port. Interfaces in Cisco IOS software are identified by a type, slot number, and port number. For example, serial 3/1 indicates port 1 on the serial port adapter in slot 3.

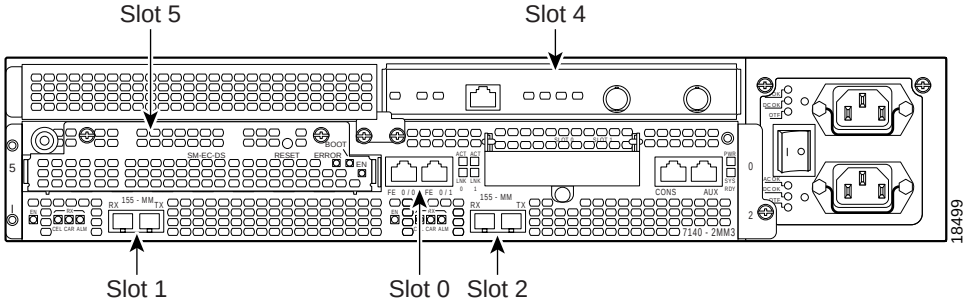
Slots in the Cisco 7120 series routers are numbered as shown in Figure 8-2. The fixed LAN interface is slot 0, the fixed WAN interface is slot 1, and the modular port adapter interface is slot 3. Slots 2 and 4 are not used in the Cisco 7120 series. Slot 5 is the service adapter.

Figure 8-2 Port Adapter Slot Numbering—Cisco 7120 Series



Slots in the Cisco 7140 series are numbered as shown Figure 8-3. The fixed LAN interface is slot 0, the fixed WAN interfaces are slots 1 and 2, and the modular port adapter interface is slot 4. Slot 3 is not used. Slot 5 is the service adapter.

Figure 8-3 Port Adapter Slot Numbering—Cisco 7140 Series



Configuring Interfaces

Use the following steps to perform a basic configuration. Press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt as follows:

```
Router# disable

Router>
```

Step 1 At the privileged-level prompt, enter configuration mode and specify that the console terminal will be the source of the configuration subcommands, as follows:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2 For the Cisco 7200 series, Cisco uBR7200 series, or Cisco 7100 series routers, at the prompt specify the first interface to configure by entering the subcommand **interface**, followed by the *type* (**hssi**) and *slot/interface* (port adapter slot number and interface number). The example that follows is for the first interface of the port adapter in slot 2.

```
Router(config)# interface hssi 2/0
```

Note For the Cisco 7206 and Cisco 7206VXR router shelves, the interface specified in the above example would include a shelf number. For example, the command **interface hssi 5/2/0** would specify the first HSSI interface of the port adapter in slot 2 of Cisco 7206 or Cisco 7206VXR router shelf 5.

For the VIP2, at the prompt specify the first interface to configure by entering the subcommand **interface**, followed by the *type* (**hssi**) and *slot/port adapter/interface* (interface processor slot number). The example that follows is for the first interface of the first port adapter on a VIP2 in interface processor slot 1:

```
Router(config)# interface hssi 1/0/0
```

For the Catalyst RSM/VIP2, at the prompt specify the first interface to configure by entering the subcommand **interface**, followed by the *type* (**hssi**) and *port adapter/interface.* The example that follows is for the first interface of the first port adapter on a Catalyst RSM/VIP2:

```
Router(config)# interface hssi 0/0
```

Step 3 If IP routing is enabled on the system, you can assign an IP address and subnet mask to the interface with the **ip address** configuration subcommand, as in the following example:

```
Router(config-int)# ip address 10.10.10.10 10.255.255.255
```

Step 4 Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.

Step 5 Change the shutdown state to up and enable the interface as follows:

```
Router(config-int)# no shutdown
```

Step 6 Configure additional interfaces as required.

Step 7 When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit configuration mode.

Step 8 Write the new configuration to nonvolatile memory as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

Note If you want to configure cyclic redundancy checks (CRCs) for your HSSI, proceed to the next section, "Configuring Cyclic Redundancy Checks." Otherwise, proceed to the "Checking the Configuration" section on page 8-8.

Configuring Cyclic Redundancy Checks

This section provides an example of how you can configure cyclic redundancy checks (CRCs) on the PA-H.

The PA-H uses a 16-bit CRC by default; it also supports a 32-bit CRC. CRC is an error-checking technique that uses a calculated numeric value to detect errors in transmitted data. The sender of a data frame divides the bits in the frame message by a predetermined number to calculate a remainder or *frame check sequence* (FCS). Before it sends the frame, the sender appends the FCS value to the message so that the frame contents are exactly divisible by the predetermined number. The receiver divides the frame contents by the same predetermined number that the sender used to calculate the FCS. If the result is not 0, the receiver assumes that a transmission error occurred.

To enable a 32-bit CRC on an interface, enter configuration mode and specify the slot and port address of the HSSI, and then enter the command **crc32**. Enter **Ctrl-Z** to exit from configuration mode.

In the following example, a single HSSI interface on a VIP2 in interface processor slot 1 is configured for a 32-bit CRC:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)# interface hssi 1/0/0
Router(config-int)# crc32
Ctrl-z
```

To disable CRC-32 and return to the default CRC-16 setting, specify the slot and port address and use the **no crc32** command.

Note When enabling a 32-bit CRC on an interface, ensure that the remote device is also configured for a 32-bit CRC. Both the sender and the receiver must use the same CRC setting.

To check the interface configuration using **show** commands, proceed to the next section "Checking the Configuration." (For additional configuration options and instructions for configuring the PA-H on the VIP2, refer to the appropriate configuration publications listed in the "Related Documentation" section on page vi.)

Checking the Configuration

After configuring the new interface, use the **show** commands to display the status of the new interface or all interfaces and the **ping** command to check connectivity.

Using show Commands to Verify the New Interface Status

Use the following steps to verify that the new interfaces are configured and operating correctly:

Step 1 Use the **show version** command to display the system hardware configuration. Ensure that the list includes the new interfaces.

Step 2 For Cisco 7100 series, Cisco 7200 series, and Cisco uBR7200 series routers, display all the current port adapters and their interfaces with the **show controllers** command. Verify that the new PA-H appears in the correct slot.

For the VIP2, display all the current interface processors and their interfaces with the **show controllers cbus** command. Verify that the new PA-H appears in the correct slot.

Note The slot values displayed by some commands (such as **show diag** and **show controllers cbus**) are not relevant to any physical connection; disregard these slot values for the Catalyst RSM/VIP2.

Step 3 For Cisco 7100 series, Cisco 7200 series, and Cisco uBR7200 series routers, specify one of the new interfaces with the **show interfaces** *port adapter type slot/interface* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Note For the Cisco 7206 and Cisco 7206VXR router shelves, the **show interfaces** command requires a shelf number in the format **show interfaces** *type shelf number/port adapter slot/interface*.

For the VIP2, specify one of the new interfaces with the **show interfaces** *type slot/port adapter/interface* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

For the Catalyst RSM/VIP2, specify one of the new interfaces with the **show interfaces** *port adapter/interface* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

Step 4 Display the protocols configured for the entire system and specific interfaces with the **show protocols** command. If necessary, return to configuration mode to add or remove protocol routing on the system or specific interfaces.

Step 5 Display the running configuration file with the **show running-config** command. Display the configuration stored in NVRAM using the **show startup-config** command. Verify that the configuration is accurate for the system and each interface.

If the interface is down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the network interface is properly connected and terminated. If you still have problems bringing the interface up, contact a service representative for assistance.

Cisco 7200 Series, Cisco uBR7200 Series, and Cisco 7100 Series show Commands

Following is an example of how the **show interfaces** [*type slot/port*] command displays status information (including the physical slot and port address) for the interfaces you specify.

```
Router# show interfaces hssi 2/0
Hssi2/0 is up, line protocol is up
Hardware is HSSI-B
  Internet address is 10.10.10.2/24
  MTU 4470 bytes, BW 45045 Kbit, DLY 200 usec, rely 252/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input never, output never, output hang never
  Last clearing of “show interface” counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
              0 parity
     1 input errors, 1 CRC, 0 frame, 1 overrun, 0 ignored, 0 abort
     1 packets output, 24 bytes, 0 underruns
     0 output errors, 0 applique, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions     TM=down  CA=up  LC=down
```

Note For the Cisco 7206 and Cisco 7206VXR router shelves, the **show interfaces** command requires a shelf number in the format **show interfaces** *type shelf number/port adapter slot/interface*.

Following is an example of the **show controller** *type slot/port* command that shows information about a specific PA-H:

```
Router# show controllers hssi 2/0

(additional display text omitted from this example)

HSSI-B: show controller:
PAS unit 0, subunit 0, f/w version 2-42, rev ID 0x2800001, version 2
idb = 0x60BDE9B0, ds = 0x60BE0740, ssb=0x60BE090C
Clock mux=0x35, ucmd_ctrl=0x8, port_status=0x25
Serial config=0x8, line config=0x1B0202
maxdgram=4474, bufpool=128Kb, 256 particles
     TM=down CA=up LC=down

line state: up
HSSI DTE cable, received clockrate 51838976

base0 registers=0x3D800000, base1 registers=0x3D802000
mxt_ds=0x60C34D1C, rx ring entries=128, tx ring entries=256
rxring=0x4B05FCC0, rxr shadow=0x60BE0A2C, rx_head=1
txring=0x4B060140, txr shadow=0x60BE1054, tx_head=0, tx_tail=0, tx_count=0
throttled=0, enabled=0, disabled=0
rx_no_eop_err=0, rx_no_stp_err=0, rx_no_eop_stp_err=0
rx_no_buf=0, rx_soft_overrun_err=0
tx_underrun_err=0, tx_soft_underrun_err=0, tx_limited=0
tx_fullring=0, tx_started=50
```

Use the **show version** command to display the configuration of the system hardware (the number of each port adapter type installed), the software version, the names and sources of configuration files, and the boot images. Following is an example of the output from the **show version** command:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 11.1(12)CA1
Copyright (c) 1986-1996 by cisco Systems, Inc.
Compiled Fri 09-Aug-96 21:14 by biff
Image text-base: 0x60010890, data-base: 0x605F0000

ROM: System Bootstrap, Version 11.1(12)CA1, RELEASED SOFTWARE
ROM: 7200 Software (C7200-J-M), Version 11.1(12)CA1, RELEASED SOFTWARE

Router uptime is 23 hours
System restarted by reload
System image file is "biff/c7200-j-mz", booted via tftp from 10.10.10.254

cisco 7200 (R4700) processor with 22528K/10240K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).

(additional display text omitted from this example)

1 HSSI network interfaces.
125K bytes of non-volatile configuration memory.

8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Use the **show diag** *slot* command to determine which type of port adapter is installed in your system. Specific port adapter information is displayed, as shown in the following example of a PA-H in port adapter slot 2:

```
Router# show diag 2
Slot 2:
        HSSI-B port adapter, 1 port
        Port adapter is analyzed
        Port adapter insertion time 2d13h ago
        Hardware revision 1.1           Board revision A0
        Serial number     4518292       Part number    73-1801-05
        Test history      0x0           RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 74 01 01 00 44 F1 94 49 07 09 05 00 00 00 00
          0x30: 50 00 00 00 97 04 21 00 FF FF FF FF FF FF FF FF
```

Note Port adapters used with the Cisco 7206 VXR routers require the correct base hardware revision in order to function. The following error message will occur on bootup if the incorrect hardware revision is used:

```
PA-3-REVNOTSUPPORTED:PA in slot 1 (Ethernet) requires base h/w revision of (1.14)
for this chassis
```

Use the **show diag** command to display the hardware revision.

Note For complete command descriptions and examples for Cisco 7200 series routers and Cisco uBR7200 series universal broadband routers, refer to the documentation resources listed in the "Related Documentation" section on page vi.

Proceed to the "Using the ping Command" section on page 8-17 to verify that each interface port is functioning properly.

VIP2 show Commands

Following is an example of how the **show interfaces** [*type slot/port-adapter/port*] command displays status information (including the physical slot and port address) for the interfaces you specify. In this example, the VIP2 is in interface processor slot 1, and the PA-H is in port adapter slot 0. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces hssi 1/0/0
Hssi1/0/0 is up, line protocol is up
 Hardware is HSSI-B
  Internet address is 10.10.10.1/24
  MTU 4470 bytes, BW 45045 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 2d22h, output 00:00:19, output hang never
  Last clearing of "show interface" counters 2d20h
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4084 packets output, 1298712 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Use the **show version** command to display the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images.

Following is an example of the **show version** command used with a Cisco 7000 series router with an RSP7000 processor:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (RSP-JV-MZ), Version 11.1(12)CA1
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 5.3(5)
ROM: GS Bootstrap Software (RSP-BOOT-M), Version 11.1(12), RELEASED SOFTWARE

Router uptime is 4 hours, 22 minutes
System restarted by reload
System image file is "slot0:rsp-jv-mz", booted via slot0

cisco RSP7000 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
```

```
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.

1 VIP2 controllers (2 HSSI).
2 HSSI network interfaces.
125K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2
```

Use the **show diag** *slot* command to determine which type of port adapter is installed on a VIP2 in your system. Specific port adapter information is displayed, as shown in the following example of two PA-H HSSI port adapters in port adapter slots (bays) 0 and 1, on a VIP2 in interface processor slot 1:

```
Router# show diag 1
Slot 2:
HSSI-B port adapter, 1 port
Port adapter is analyzed
Port adapter insertion time 2d13h ago
Hardware revision 1.17          Board revision A0
Serial number     4518292       Part number    73-1801-05
Test history      0x0           RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20:01 74 01 11 00 44 F1 94 49 07 09 05 00 00 00 00
0x30:50 00 00 00 97 04 21 00 FF FF FF FF FF FF FF FF

        Slot database information:
        Flags: 0x4      Insertion time: 0x14E8 (3d00h ago)

        VIP Controller Memory Size: Unknown

        PA Bay 0 Information:
                HSSI-B PA, 1 ports
                EEPROM format version 1
                HW rev 1.1, Board revision A0
                Serial number: 04551053 Part number: 73-1801-05

        PA Bay 0 Information:
                HSSI-B PA, 1 ports
                EEPROM format version 1
                HW rev 1.1, Board revision A0
                Serial number: 04518147 Part number: 73-1801-05
```

Use the **show controllers cbus** command to display all the current interface processors and their interfaces. Following is an example of the **show controllers cbus** command that shows the HSSI port 1/0/0 on a PA-H HSSI port adapter installed on a VIP2 in interface processor slot 1:

```
Router# show controllers cbus

(additional displayed text omitted from this example)

slot1: VIP2, hw 2.3, sw 21.40, ccb 5800FF40, cmdq 48000090, vps 8192
    software loaded from system
    IOS (tm) VIP Software (SVIP-DW-M), Released Version 11.1(12)CA1 [biff 103]
    ROM Monitor version 17.0
  HSSI-B(1) HW Revision 0x2, FW Revision 2.42
    Hssi1/0/0, applique is Hssi DTE
      received clockrate 51838976
      gfreeq 48000160, lfreeq 48000200 (4480 bytes), throttled 0
      rxlo 4, rxhi 258, rxcurr 0, maxrxcurr 0
      txq 48001A80, txacc 48001A82 (value 129), txlimit 129

(additional displayed text omitted from this example)
```

Note For complete VIP2 command descriptions and examples, refer to the documentation resources listed in the "Related Documentation" section on page vi.

Proceed to the next section "Using the ping Command" to verify that each interface port is functioning properly.

Catalyst RSM/VIP2 show Commands

Caution If you are using the high-speed serial interface (HSSI) port adapter in the Catalyst 5000, 5500, 5505, or 5509 switch, you must install the port adapter on the Catalyst RSM/VIP2 (either -15 or -40) Revision 2 (board part number 73-3468-XX, where XX is the version number). Do not use the HSSI dual-port adapter in the Catalyst 5000, 5505, or 5509 switch if you are installing it on a Catalyst RSM/VIP2 (either -15 or -40) module that is not the Revision 2. If you fail to comply with this restriction, your system will shut down due to an overload of the power supply.

Caution You can only have two HSSI port adapters per chassis when installed on a Catalyst RSM/VIP2-15 or -40 module Revision 1 and used in the Catalyst 5500 switch.

Following is an example of how the **show interfaces** [*port-adapter/port*] command displays status information for the interfaces you specify. In this example, the PA-H is in port adapter slot 0 on the Catalyst RSM/VIP2. (Interfaces are administratively shut down until you enable them.)

```
Router# show interfaces hssi 0/0
Hssi0/0 is up, line protocol is up
 Hardware is HSSI-B
  Internet address is 10.10.10.1/24
  MTU 4470 bytes, BW 45045 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 2d22h, output 00:00:19, output hang never
  Last clearing of “show interface” counters 2d20h
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4084 packets output, 1298712 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

Use the **show version** command to display the configuration of the system hardware (the number of each interface processor type installed), the software version, the names and sources of configuration files, and the boot images.

Following is an example of the **show version** command:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) GS Software (C5RSM-JV-MZ), Version 11.1(12)CA1
Copyright (c) 1986-1995 by cisco Systems, Inc.
Compiled Fri 06-Oct-95 12:22 by mpo
Image text-base: 0x600088A0, data-base: 0x605A4000

ROM: System Bootstrap, Version 5.3(5)
ROM: GS Bootstrap Software (RSP-BOOT-M), Version 11.1(12), RELEASED SOFTWARE

Router uptime is 4 hours, 22 minutes
System restarted by reload
System image file is “slot0:c5rsm-jv-mz”, booted via slot0

cisco RSP7000 (R4600) processor with 16384K bytes of memory.
R4600 processor, Implementation 32, Revision 2.0
Last reset from power-on
G.703/E1 software, Version 1.0.
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
Chassis Interface.

1 VIP2 controllers (2 HSSI).
2 HSSI network interfaces.
125K bytes of non-volatile configuration memory.

20480K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2
```

Use the **show diag** *slot* command to determine which type of port adapter is installed on a Catalyst RSM/VIP2 in your system. Specific port adapter information is displayed, as shown in the following example of a PA-H HSSI port adapter in port adapter slot (bay) 0, on a Catalyst RSM/VIP2:

```
Router# show diag 0
Slot 0:
HSSI-B port adapter, 1 port
Port adapter is analyzed
Port adapter insertion time 2d13h ago
Hardware revision 1.17          Board revision A0
Serial number     4518292       Part number    73-1801-05
Test history      0x0           RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20:01 74 01 11 00 44 F1 94 49 07 09 05 00 00 00 00
0x30:50 00 00 00 97 04 21 00 FF FF FF FF FF FF FF FF

        Slot database information:
        Flags: 0x4      Insertion time: 0x14E8 (3d00h ago)

        VIP Controller Memory Size: Unknown

        PA Bay 0 Information:
                HSSI-B PA, 1 ports
                EEPROM format version 1
                HW rev 1.1, Board revision A0
                Serial number: 04551053 Part number: 73-1801-05
```

Use the **show controllers cbus** command to display all the current interface processors and their interfaces. Following is an example of the **show controllers cbus** command that shows the HSSI port 1/0/0 on a PA-H HSSI port adapter installed on a VIP2 in interface processor slot 1:

```
Router# show controllers cbus

(additional displayed text omitted from this example)

slot1: VIP2, hw 2.3, sw 21.40, ccb 5800FF40, cmdq 48000090, vps 8192
    software loaded from system
    IOS (tm) VIP Software (SVIP-DW-M), Released Version 11.1(12)CA1 [biff 103]
    ROM Monitor version 17.0
  HSSI-B(1) HW Revision 0x2, FW Revision 2.42
    Hssi1/0/0, applique is Hssi DTE
      received clockrate 51838976
      gfreeq 48000160, lfreeq 48000200 (4480 bytes), throttled 0
      rxlo 4, rxhi 258, rxcurr 0, maxrxcurr 0
      txq 48001A80, txacc 48001A82 (value 129), txlimit 129

(additional displayed text omitted from this example)
```

Note The slot values displayed by some commands (such as **show diag** and **show controllers cbus**) are not relevant to any physical connection; disregard these slot values for the Catalyst RSM/VIP2.

Note For complete Catalyst RSM/VIP2 command descriptions and examples, refer to the documentation resources listed in the "Related Documentation" section on page vi.

Proceed to the next section “Using the ping Command” to verify that each interface port is functioning properly.

Using the ping Command

The **ping** command allows you to verify that an interface port is functioning properly and to check the path between a specific port and connected devices at various locations on the network. This section provides brief descriptions of the **ping** command. After you verify that the system has booted successfully and is operational, you can use this command to verify the status of interface ports. Refer to the documentation resources listed in the “Related Documentation” section on page vi for detailed command descriptions and examples.

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the command waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate that the connection failed.

Following is an example of a successful **ping** command to a remote server with the address 10.10.10.10:

```
Router# ping 10.10.10.10
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.10.10.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), and repeat the **ping** command.

This completes the PA-H interface installation and configuration.